



# Paragon Analytics

## Radiochemistry Case Narrative <sup>228</sup>Radium by Method 9320

---

**Kent & Sullivan Inc.**

Ross Adams

Paragon WO 0405095

1. This report consists of the analytical results and supporting documentation for seven water samples received by Paragon on 5/11/04.
2. These samples were prepared according to SW-846 Method 9320, Paragon SOP746R7. Procedure 9320 was modified as follows: The chemical yield was determined by ICP-AES measurement of the pre- and post separation concentration of Ba and Y in these samples.
3. The samples were analyzed for the presence of Ra-228 by low background gas flow proportional counting (Paragon SOP724R8) of the ingrown progeny of radium-228, actinium-228. The analyses were completed on 6/21/04.
4. The analysis results for these samples are reported in units of pCi/L. The samples were not filtered prior to analysis.
5. Due to insufficient sample volume, a duplicate laboratory control sample (LCS) was prepared in lieu of a client sample duplicate for both batches associated with this work order.
6. ICP-AES measurement of barium concentrations prior to chemical separation for some of these samples showed concentrations less than the amount known to have been added to the sample in the form of barium carrier. To avoid a low bias in the final analytical results the known concentration of the carrier was used in chemical yield calculations in lieu of the pre-separation measurement. These samples are identified with an "LB" flag on the Radiochemistry ICP Worksheet, which can be found in Section 4, "Raw Data" of this report.
7. Similarly, a significant low bias (greater than -15%) was observed in the pre-separation ICP measurement for some of these samples. This may be an indication of some matrix interference in the initial yield determination. To minimize low bias in the final analytical results the known concentration of the carrier solution was used in chemical yield calculations in lieu of the preseparation measurement. These samples are identified with a "15%" flag on the Radiochemistry ICP Worksheet, which can be found in Section 4, "Raw Data" of this report.
8. Due to uncertainty associated with the ICP-AES determination of barium concentration in the samples, the calculated yield for the duplicate of the LCS in batch RA040616-1 (PA ID RA040616-1LCSD) fell between 100% and 110%. To minimize the potential for low bias, results have been calculated conservatively assuming quantitative chemical yield (100%). The magnitude of the low bias is estimated to be less than 10% of the reported value and is

000001

PARAGON ANALYTICS

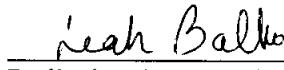
acceptable according the Paragon LQAP. This sample is identified with a "Y1" flag on the final reports.

9. Due to previous sample history an increased aliquot was used for the preparation of these samples. However, following an extended count time (250 minutes), the requested client MDC of 1.0 pCi/L was still not achieved for samples SW-02 and SW-04 (PA ID 0405095-2 and -3). These samples are identified with an "M" flag on the final reports.
10. No anomalous situations were noted during the preparation and analysis of these samples. All quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, Paragon Analytics certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
\_\_\_\_\_  
Radiochemistry Instrument Technician

6-25-04  
Date

  
\_\_\_\_\_  
Radiochemistry Final Data Review

6/28/04  
Date

000002

PARAGON ANALYTICS  
Radiochemistry Data Package

Section 1

**SAMPLE RESULTS  
SUMMARY**

# Radium-228 Analysis by GFPC Sample Results Summary

Client Name: Kent & Sullivan Inc.

Client Project Name: Ross Adams

Client Project Number:

Laboratory Name: Paragon Analytics  
PAI Work Order: 0405095

Reported on: Friday, June 25, 2004  
12:40:25 PM

Page: 1 of 1

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0405095-1	SW-01	Sample	Ra-228	0.17 +/- 0.23	0.48	pCi/l	WATER	RA040602-1	6/7/2004	U
0405095-2	SW-02	Sample	Ra-228	0.36 +/- 0.29	0.54	pCi/l	WATER	RA040602-1	6/7/2004	U,M
0405095-3	SW-04	Sample	Ra-228	0.23 +/- 0.26	0.52	pCi/l	WATER	RA040602-1	6/7/2004	U,M
0405095-4	SW-05	Sample	Ra-228	0.46 +/- 0.28	0.48	pCi/l	WATER	RA040602-1	6/7/2004	U
0405095-6	SW-07	Sample	Ra-228	2.18 +/- 0.71	0.47	pCi/l	WATER	RA040602-1	6/7/2004	
0405095-7	SW-08	Sample	Ra-228	0.40 +/- 0.21	0.32	pCi/l	WATER	RA040616-1	6/21/2004	L,T
0405095-8	SW-09	Sample	Ra-228	1.94 +/- 0.63	0.39	pCi/l	WATER	RA040616-1	6/21/2004	

## Comments:

## Data Package ID: ra2280405095-1

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

L,T - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Date Printed: Friday, June 25, 2004

Paragon Analytics  
LIMS Version: 5.037A

Page 1 of 1

00004

**2**

**PARAGON ANALYTICS**  
**Radiochemistry Data Package**

**Section 2**

**QC RESULTS  
SUMMARY**

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Method Blank Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Lab ID: RA040602-1MB	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7	Prep Batch: RA040602-1 QCBatchID: RA040602-1-1 Run ID: ra040602-1a Count Time: 250 minutes	Final Aliquot: 2990 ml Result Units: pCi/l File Name: raa0607
	Date Collected: 02-Jun-04 Date Prepared: 02-Jun-04 Date Analyzed: 07-Jun-04		

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	0.23 +/- 0.22	0.42	U

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	34840	26800	ug	76.9	40 - 110 %	
YTTRIUM	8335	6505	ug	78.0	40 - 110 %	
Total				60.0	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Method Blank Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Lab ID: RA040616-1MB	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7	Prep Batch: RA040616-1 QCBatchID: RA040616-1A Run ID: RA040616-1A Count Time: 250 minutes	Final Aliquot: 2990 ml Result Units: pCi/l File Name: RAB0621
	Date Collected: 16-Jun-04 Date Prepared: 16-Jun-04 Date Analyzed: 21-Jun-04		

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	0.08 +/- 0.17	0.34	U

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	28730	26130	ug	91.0	40 - 110 %	
YTTRIUM	8380	6117	ug	73.0	40 - 110 %	
Total				66.4	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Laboratory Control Sample(s)

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Lab ID: RA040602-1LCS	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7	Prep Batch: RA040602-1 QCBatchID: RA040602-1-1 Run ID: ra040602-1a Count Time: 250 minutes	Final Aliquot: 2990 ml Result Units: pCi/l File Name: raa0607
	Date Collected: 02-Jun-04 Date Prepared: 02-Jun-04 Date Analyzed: 07-Jun-04		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
15262-20-1	Ra-228	8.7 +/- 2.6	0.4	8.90	97.2	70 - 130	P

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	34840	28350	ug	81.4	40 - 110 %	
YTTRIUM	8335	6263	ug	75.1	40 - 110 %	
Total				61.1	40 - 110 %	

## Comments:

### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

### Abbreviations:

- TPU - Total Propagated Uncertainty (see PAI SOP 743)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Laboratory Control Sample(s)

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Lab ID: RA040602-1LCSD	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7	Prep Batch: RA040602-1 QCBatchID: RA040602-1-1	Final Aliquot: 2990 ml Result Units: pCi/l File Name: raa0607
	Date Collected: 02-Jun-04	Run ID: ra040602-1a	
	Date Prepared: 02-Jun-04	Count Time: 250 minutes	
	Date Analyzed: 07-Jun-04		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
15262-20-1	Ra-228	8.9 +/- 2.7	0.4	8.90	99.7	70 - 130	P

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	34840	28680	ug	82.3	40 - 110 %	
YTTRIUM	8335	6517	ug	78.2	40 - 110 %	
Total				64.4	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Laboratory Control Sample(s)

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Lab ID: RA040616-1LCS	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7	Prep Batch: RA040616-1 QCBatchID: RA040616-1-1 Run ID: RA040616-1A Count Time: 60 minutes	Final Aliquot: 2990 ml Result Units: pCi/l File Name: RAB0621A
	Date Collected: 16-Jun-04		
	Date Prepared: 16-Jun-04		
	Date Analyzed: 21-Jun-04		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
15262-20-1	Ra-228	8.1 +/- 2.5	0.6	8.86	91.8	70 - 130	P,M3

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	28730	25570	ug	89.0	40 - 110 %	
YTTRIUM	8380	6345	ug	75.7	40 - 110 %	
Total				67.4	40 - 110 %	

## Comments:

### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

### Abbreviations:

- TPU - Total Propagated Uncertainty (see PAI SOP 743)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Laboratory Control Sample(s)

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Lab ID: RA040616-1LCSD	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7	Prep Batch: RA040616-1 QCBatchID: RA040616-1-1 Run ID: RA040616-1A Count Time: 60 minutes	Final Aliquot: 2990 ml Result Units: pCi/l File Name: RAB0621A
	Date Collected: 16-Jun-04 Date Prepared: 16-Jun-04 Date Analyzed: 21-Jun-04		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
15262-20-1	Ra-228	7.5 +/- 2.3	0.6	8.86	85.1	70 - 130	P,M3

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	28730	28850	ug	100	40 - 110 %	Y1
YTTRIUM	8380	6068	ug	72.4	40 - 110 %	
Total				72.4	40 - 110 %	

## Comments:

### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

### Abbreviations:

- TPU - Total Propagated Uncertainty (see PAI SOP 743)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Duplicate Sample Results (DER)

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID: Lab ID: RA040602-1LCSD	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7 Date Collected: 02-Jun-04 Date Prepared: 02-Jun-04 Date Analyzed: 07-Jun-04	Prep Batch: RA040602-1 QCBatchID: RA040602-1-1 Run ID: ra040602-1a Count Time: 250 minutes	Final Aliquot: 2990 ml Prep Basis: Unfiltered Moisture(%): NA Result Units: pCi/l File Name: raa0607
-------------------------------------	--	---	--

CASNO	Analyte	Sample Result +/- 2 s TPU	Duplicate Result +/- 2 s TPU	DER	Control Limit	Lab Qualifiers
15262-20-1	Ra-228	8.7 +/- 2.6	8.9 +/- 2.7	0.06	2.13	P

### Comments:

#### Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.  
Y2 - Chemical Yield outside default limits.  
W - DER is greater than Warning Limit of 1.42  
D - DER is greater than Control Limit of 2.13  
LT - Result is less than Request MDC, greater than sample specific MDC  
M - Requested MDC not met.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
L - LCS Recovery below lower control limit.  
H - LCS Recovery above upper control limit.  
P - LCS, Matrix Spike Recovery within control limits.  
N - Matrix Spike Recovery outside control limits

#### Abbreviations:

- TPU - Total Propagated Uncertainty (see PAI SOP 743)  
DER - Duplicate Error Ratio  
BDL - Below Detection Limit  
NR - Not Reported

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Duplicate Sample Results (DER)

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID:	Sample Matrix: WATER
Lab ID:	Prep SOP: PAI 746 Rev 7

Date Collected: 16-Jun-04  
Date Prepared: 16-Jun-04  
Date Analyzed: 21-Jun-04

Prep Batch: RA040616-1  
QCBatchID: RA040616-1-1  
Run ID: RA040616-1A  
Count Time: 60 minutes

Final Aliquot: 2990 ml  
Prep Basis: Unfiltered  
Moisture(%): NA  
Result Units: pCi/l  
File Name: RAB0621A

CASNO	Analyte	Sample Result +/- 2 s TPU	Duplicate Result +/- 2 s TPU	DER	Control Limit	Lab Qualifiers
15262-20-1	Ra-228	8.1 +/- 2.5	7.5 +/- 2.3	0.17	2.13	P,M3

### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

#### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

Data Package ID: RA2280405095-1

Date Printed: Friday, June 25, 2004

Paragon Analytics

LIMS Version: 5.037A

Page 2 of 2

000013

**PARAGON ANALYTICS**  
**Radiochemistry Data Package**

**3**

**Section 3**

**INDIVIDUAL  
SAMPLE RESULTS**

**000014**

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID: SW-01 Lab ID: 0405095-1	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7 Date Collected: 05-May-04 Date Prepared: 02-Jun-04 Date Analyzed: 07-Jun-04	Prep Batch: RA040602-1 QCBatchID: RA040602-1-1 Run ID: ra040602-1a Count Time: 250 minutes Report Basis: Unfiltered	Final Aliquot: 2990 ml Prep Basis: Unfiltered Moisture(%): NA Result Units: pCi/l File Name: raa0607
--------------------------------------	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	0.17 +/- 0.23	0.48	U

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	34840	26590	ug	76.3	40 - 110 %	
YTTRIUM	8335	6825	ug	81.9	40 - 110 %	
Total				62.5	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID: SW-02 Lab ID: 0405095-2	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7 Date Collected: 05-May-04 Date Prepared: 02-Jun-04 Date Analyzed: 07-Jun-04	Prep Batch: RA040602-1 QCBatchID: RA040602-1-1 Run ID: ra040602-1a Count Time: 250 minutes Report Basis: Unfiltered	Final Aliquot: 2990 mL Prep Basis: Unfiltered Moisture(%): NA Result Units: pCi/l File Name: raa0607
--------------------------------------	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	0.36 +/- 0.29	0.54	U,M

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	34860	26400	ug	75.7	40 - 110 %	
YTTRIUM	8335	5833	ug	70.0	40 - 110 %	
Total				53.0	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID: SW-04 Lab ID: 0405095-3	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7 Date Collected: 04-May-04 Date Prepared: 02-Jun-04 Date Analyzed: 07-Jun-04	Prep Batch: RA040602-1 QCBatchID: RA040602-1-1 Run ID: ra040602-1a Count Time: 250 minutes Report Basis: Unfiltered	Final Aliquot: 2990 ml Prep Basis: Unfiltered Moisture(%): NA Result Units: pCi/l File Name: raa0607
--------------------------------------	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	0.23 +/- 0.26	0.52	U,M

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	34880	26340	ug	75.5	40 - 110 %	
YTTRIUM	8335	5948	ug	71.4	40 - 110 %	
Total				53.9	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID: SW-05  
Lab ID: 0405095-4

Sample Matrix: WATER  
Prep SOP: PAI 746 Rev 7  
Date Collected: 06-May-04  
Date Prepared: 02-Jun-04  
Date Analyzed: 07-Jun-04

Prep Batch: RA040602-1  
QCBatchID: RA040602-1-1  
Run ID: ra040602-1a  
Count Time: 250 minutes  
Report Basis: Unfiltered

Final Aliquot: 2990 ml  
Prep Basis: Unfiltered  
Moisture(%): NA  
Result Units: pCi/l  
File Name: raa0607

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	0.46 +/- 0.28	0.48	U

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	34880	25870	ug	74.2	40 - 110 %	
YTTRIUM	8335	6153	ug	73.8	40 - 110 %	
Total				54.8	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID: SW-07 Lab ID: 0405095-6	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7 Date Collected: 03-May-04 Date Prepared: 02-Jun-04 Date Analyzed: 07-Jun-04	Prep Batch: RA040602-1 QCBatchID: RA040602-1-1 Run ID: ra040602-1a Count Time: 250 minutes Report Basis: Unfiltered	Final Aliquot: 2990 ml Prep Basis: Unfiltered Moisture(%): NA Result Units: pCi/l File Name: raa0607
--------------------------------------	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	2.18 +/- 0.71	0.47	

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	34840	26180	ug	75.1	40 - 110 %	
YTTRIUM	8335	6151	ug	73.8	40 - 110 %	
Total				55.5	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID: SW-08  
Lab ID: 0405095-7

Sample Matrix: WATER  
Prep SOP: PAI 746 Rev 7  
Date Collected: 03-May-04  
Date Prepared: 16-Jun-04  
Date Analyzed: 21-Jun-04

Prep Batch: RA040616-1  
QCBatchID: RA040616-1-1  
Run ID: RA040616-1A  
Count Time: 250 minutes  
Report Basis: Unfiltered

Final Aliquot: 2990 ml  
Prep Basis: Unfiltered  
Moisture(%): NA  
Result Units: pCi/l  
File Name: RAB0621

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	0.40 +/- 0.21	0.32	LT

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	28750	26820	ug	93.3	40 - 110 %	
YTTRIUM	8380	6241	ug	74.5	40 - 110 %	
Total				69.5	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: RA2280405095-1

# Radium-228 Analysis by GFPC

PAI 724 Rev 8

## Sample Results

Lab Name: Paragon Analytics

Work Order Number: 0405095

Client Name: Kent & Sullivan Inc.

ClientProject ID: Ross Adams

Field ID: SW-09 Lab ID: 0405095-8	Sample Matrix: WATER Prep SOP: PAI 746 Rev 7 Date Collected: 05-May-04 Date Prepared: 16-Jun-04 Date Analyzed: 21-Jun-04	Prep Batch: RA040616-1 QCBatchID: RA040616-1-1 Run ID: RA040616-1A Count Time: 250 minutes Report Basis: Unfiltered	Final Aliquot: 2990 ml Prep Basis: Unfiltered Moisture(%): NA Result Units: pCi/l File Name: RAB0621
--------------------------------------	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Lab Qualifier
15262-20-1	Ra-228	1.94 +/- 0.63	0.39	

## Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
BARIUM	28730	26020	ug	90.6	40 - 110 %	
YTTRIUM	8380	5428	ug	64.8	40 - 110 %	
Total				58.7	40 - 110 %	

## Comments:

### Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

### Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: RA2280405095-1

PARAGON ANALYTICS  
Radiochemistry Data Package

Section 4

4

**RAW DATA**

000022

# Radium-228 Analysis by GFPC Raw Data Report

Laboratory Name: Paragon Analytics

PAI Work Order: 0405095

Prep SOP: PAI 746  
Analytical SOP: PAI 724

Reported on: Tuesday, June 15, 2004  
12:20:59 PM

Sample ID	Nuclide	Sample Date/Time	Prep Batch QCBatchID	Ingrrowth Date/Time	Decay Date/Time	Matrix %Moist.	Samp Aliq Analy Aliq	Inst ID Det ID	AnRunID File Name	Count Date/Time	GrossCPM BkgCPM	BaseEff ProgEff	CrtdDur(min) Yield	Activity +/- 2 s TPU	MDC DeclLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
0405095-1	Ra-228	5/5/2004 4:40:00 PM	RA040602-1	6/03/2004 3:00:00 PM	6/07/2004 10:20:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a A1	rap040602-1a raa0607	6/7/2004 1:33 PM	2,298 2,132	40.67% NA	250 0.23	0.17 0.48	pCiL	NA	NA	U
0405095-2	Ra-228	5/5/2004 3:50:00 PM	RA040602-1	6/03/2004 3:00:00 PM	6/07/2004 10:20:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a A3	rap040602-1a raa0607	6/7/2004 1:33 PM	2,300 2,015	40.97% NA	250 0.29	0.36 0.54	pCiL	NA	Unfilled	NA
0405095-3	Ra-228	5/4/2004 5:52:00 PM	RA040602-1	6/03/2004 3:00:00 PM	6/07/2004 10:20:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a A4	rap040602-1a raa0607	6/7/2004 1:33 PM	2,164 1,974	41.19% NA	250 0.26	0.23 0.52	pCiL	NA	Unfilled	NA
0405095-4	Ra-228	5/6/2004 11:45:00 AM	RA040602-1	6/03/2004 3:00:00 PM	6/07/2004 10:20:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a B4	rap040602-1a raa0607	6/7/2004 1:33 PM	1,798 1,798	NA 54.8%	250 0.28	0.46 0.48	pCiL	NA	Unfilled	NA
0405095-5	Ra-228	5/3/2004 4:03:00 PM	RA040602-1	6/03/2004 3:00:00 PM	6/07/2004 10:20:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a C1	rap040602-1a raa0607	6/7/2004 1:33 PM	3,540 1,702	41.82% NA	250 0.71	2.18 0.47	pCiL	NA	Unfilled	NA
0405095-7	Ra-228	5/3/2004 4:59:00 PM	RA040616-1	6/17/2004 3:40:00 PM	6/21/2004 10:10:00 AM	WATER NA	3000 mL 2990 mL	LB4100-B A1	RA040616-1A RA06021	6/21/2004 1:21 PM	1,696 1,276	42.04% NA	250 0.21	0.40 0.32	pCiL	NA	Unfilled	NA
0405095-8	Ra-228	5/5/2004 12:30:00 PM	RA040616-1	6/17/2004 3:40:00 PM	6/21/2004 10:10:00 AM	WATER NA	3000 mL 2990 mL	LB4100-B A2	RA040616-1A RA06021	6/21/2004 1:21 PM	1,269 1,269	NA 58.5%	250 0.63	0.36 0.37	pCiL	NA	Unfilled	NA
RA040602-1	Ra-228	6/2/2004 10:40:52 AM	RA040602-1	6/03/2004 3:00:00 PM	6/07/2004 10:20:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a C2	rap040602-1a raa0607	6/7/2004 1:33 PM	1,924 1,706	42.35% NA	250 0.22	0.23 0.42	pCiL	NA	Unfilled	NA
RA040602-1	Ra-228	6/2/2004 10:40:52 AM	RA040602-1	6/03/2004 3:00:00 PM	6/07/2004 10:20:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a C3	rap040602-1a raa0607	6/7/2004 1:33 PM	2,964 1,711	40.96% NA	250 0.61	0.39 0.39	pCiL	NA	Unfilled	NA
LCS	Tg Analyte	6/16/2004 3:47:24 PM	RA040616-1	6/17/2004 3:40:00 PM	6/21/2004 10:10:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a C4	rap040616-1A RA06021	6/21/2004 1:21 PM	1,269 1,269	NA 58.7%	250 0.63	0.36 0.37	pCiL	NA	Unfilled	NA
RA040602-1	Ra-228	6/2/2004 10:40:52 AM	RA040602-1	6/03/2004 3:00:00 PM	6/07/2004 10:20:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a C5	rap040602-1a raa0607	6/7/2004 1:33 PM	1,905 1,706	NA 60.0%	250 0.22	0.23 0.42	pCiL	NA	Unfilled	NA
RA040602-1	Ra-228	6/16/2004 3:47:24 PM	RA040616-1	6/17/2004 3:40:00 PM	6/21/2004 10:10:00 AM	WATER NA	3000 mL 2990 mL	LB4100-a C6	rap040616-1A RA06021	6/21/2004 1:21 PM	1,432 1,352	41.83% NA	250 0.17	0.34 0.34	pCiL	NA	Unfilled	NA

Comments:

Data Package ID: ra2280405095-1

Qualifiers/Flags:

U - Result is less than the sample specific MDC.  
Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.  
Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning limit of 1.42

D - DER is greater than Control Limit of 2.13

+ - Duplicate RPD not within limits.

L - Result is less than Request MDC, greater than sample specific MDC

\* - Aliquots Basis is 'As Received' while the Report Basis is 'Dry Weight'.

# - Aliquots Basis is 'Dry Weight' while the Report Basis is 'As Received'.

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

NC - Not Calculated for duplicate results less than 5 times MDC

B - Analyte concentration greater than MDC.

83 - Analyte concentration greater than MDC but less than Requested MDC.

Notes:

1) The Tracer results are not yet corrected (i.e. activity measured not activity added).  
2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

Abbreviations:

TR - Tracer TA - Target Analyze

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

DER - Duplicate Error Ratio

BDL - Below Detection Limit

# Radium-228 Analysis by GFPC Raw Data Report

Laboratory Name: Paragon Analytics

PAI Work Order: 0405095

Prep SOP: PAI746  
Analytical SOP: PAI724

Reported on: Friday, June 25, 2004  
12:35:47 PM

Sample ID	Nuclide	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date / Time	Decay Date/Time	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	GrossCPM BkgCPM	BaseEff ProgEff	CntDur(min) Yield	Activity +/- 2 s TPU	MDC Decl.Elev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
RA040616-1	Ra-228	6/16/2004 3:47:24 PM	RA040616-1	6/17/2004 3:40:00 PM	6/21/2004 10:10:00 AM	WATER 3000 mL	NA 2990 mL	LB410-B A4	RA040616-1A RAB0621A	6/21/2004 1:26 PM	11,483 1,363	42.62% NA	60 67.4%	8.1 2.5	0.6 NA	pCiL Unfiltered	NA	91.8 P,M3
RA040616-1	Ra-228	6/16/2004 3:47:24 PM	RA040616-1	6/17/2004 3:40:00 PM	6/21/2004 10:10:00 AM	WATER 3000 mL	NA 2990 mL	LB410-B B3	RA040616-1A RAB0621A	6/21/2004 1:26 PM	11,683 1,424	43.37% NA	60 72.4%	7.5 2.3	0.6 NA	pCiL Unfiltered	NA	85.1 P,M3
LCSD	Tg. Analyte	3:47:24 PM	RA040616-1	6/17/2004 3:40:00 PM	6/21/2004 10:10:00 AM	WATER 3000 mL	NA 2990 mL											

## Comments:

## Data Package ID: ra2280405095-1

### Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- L1 - Result is less than Request MDC, greater than sample specific MDC
- \* - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

### Notes:

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

### Abbreviations:

- TR - Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty (see PAI SOP 743)
- MDC - Minimum Detectable Concentration (see PAI SOP 709)
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

# PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W  
 Counting Unit ID: Orange  
 High Voltage Mode: Simultaneous  
 Application Revision: C  
 Application Version: PAI Rev.12/26/03 JE

Data file name: RAA0607  
 Batch ID: RA040602-1  
 Count Preset (m): 250  
 Batch Ended: 6/7/04 17:48

Alpha Attenuation Calibration		Beta Attenuation Calibration	
Y = 2.701e+00(mass-x0)		Y = 1.2020(Beta/ba)	
Alpha/ba =	1.0000	Beta/ba	
m=	0.99440	m=	0.9999
n=	1.0000	a=	1.0000
x0=	0.0000	x0=	0.0000
Alpha to Beta X-talk		Beta to Alpha X-talk	
Y = b/m*mass		Y = b/m*mass	
a->b xtalk ba		b->a xtalk m=	-2.00E-06
a->b xtalk m=	0.22256	b->a xtalk m=	0.0007
a->b xtalk m=	1.0000	b->a xtalk m=	0.0007

Det. ID	Sample ID	Alpha Activity						Beta Activity					
		Count	End Date & Time	Resid. Dur.	Gross Mass (mg)	Bkg. CPM	b>a xtalk CPM	Base Eff.	Progeny Cor.Fact.	Gross CPM	Bkg. a>b xtalk CPM	Base Eff.	Progeny Cor.Fact.
AT	QD05095-1	6/7/04 17:48	250.00	0.0	0.118	0.130	0.002	0.2652	1.220	2.288	2.132	0.0298	0.0057
A3	QD05095-2	6/7/04 17:48	250.00	0.0	0.136	0.097	0.002	0.2645	1.220	n/a	2.300	0.0315	0.0037
A4	QD05095-3	6/7/04 17:48	250.00	0.0	0.116	0.096	0.002	0.2625	1.220	n/a	2.154	0.0298	n/a
B4	QD05095-4	6/7/04 17:48	250.00	0.0	0.144	0.068	0.002	0.2668	1.220	n/a	1.98	0.0320	0.4119
C1	QD05095-5	6/7/04 17:48	250.00	0.0	0.092	0.071	0.002	0.2761	1.220	n/a	2.188	0.0265	0.4286
C2	RA040602-LMB	6/7/04 17:48	250.00	0.0	0.104	0.059	0.001	0.2785	1.220	n/a	1.702	0.0295	0.4182
C3	RA040602-LCS	6/7/04 17:48	250.00	0.0	0.198	0.085	0.007	0.2674	1.220	n/a	1.824	0.0231	0.4235
C4	RA040602-LCSD	6/7/04 17:48	250.00	0.0	0.148	0.082	0.008	0.2728	1.220	n/a	10.032	1.000	0.0436
										10.784	1.000	0.4226	0.4229

6/7/04

000025

pg 276945 a  
 (cont. from pg 51A) b

## Paragon Analytics, Inc.

### Low Background Gas Flow Proportional Counter Log

Instrument: **LB4100A**

Date: 6/7/04

#### *Instrument Background and Response Checklist*

		Instrument Background and Response Checklist								
		Det	DR	DR	DR	Cmnt	Bkg	Bkg	Cmnt	On-line
		.1	.1	.2	Stat		1	2	Stat	
P-10 Supply	P-10 Flow									
12000	A G. 1	1	L				1	1		
2000	B	2								
	C	3								
	D NP	4								
Bkg.	Cal. File ID									
Dr A	Alpha	5	L	R	O					
Dr B	Beta	6								
Dr C		7								
Dr D	NP	8								

P = passes; R = Recount; H = high; L = low; W = weekly; α = Alpha; B = Beta; DR = Daily Response Check; Stat = Status; Det = Status; Bkg = Background; OL = Offline; NP = Not Processed.

#### *Runlog*

Det	SimpID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Cmnt Below
1-12	DR Checks	-	-	EFA0606-7	30	0615	L	C	6/7/04	N/A
5-6-7	DR Recount	-	-	EFA0607A	30	0631	L	C	6/7/04	N/A
5	Daily Checks	-	-	EFA0607B	30	0733	C	C	7/7/04	
1-12	Da. by Bkg	-	-	EFA0607C	30	910	X	X		
1	04 06 036-2	A3040607-1	A3	BKA0607	60	925	I	I		
3	-3			A340607	10	1050	X	X	7/7/04	
4	-4	.	.							
5	-5									
6	-6									
10	-7									
11	-8									
12	-10									
1	-11									
3	-12									
4	-13									

Form 780r6.frm (4/6/2001)

Comments:

Reviewed by \_\_\_\_\_

Date 7/7/04

Date 6/7/04

**Low Background Gas Flow Proportional Counter Log**  
**Instrument: LB4100A**

6/7/04

Det	SimpID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Count Below
8	04 06 036-14	AB040607-1	AB	ABA0607A	10	1103	72	72	6.7.04	NA
9	-15									
10	-16									
11	-17									
12	-19									
1	-20									
3	-18									
4	-19D									
8	-20									
9	-22									
10	-23									
11	AB040607-ACCS									
12	-18CCS									
1	-1MB									
3	04 06 036-24	AB040607-2								
4	-25									
8	-26									
9	-27									
10	-28									
11	AB040607-2ACCS									
12	-18CCS									
11	04 06 036-2SD									
12	AB040607-2MB									
1	0405095-1	BA040602-1	BA228	RAA0607	250	1345	6.8.04	72	6.8.04	
3	.	-2								
4	.	-3								
5	.	-4								
9	.	-5								
10	R1040602-1MB									
11	.	-1CCS								

Form 780r6.frm (4/6/2001)

Comments:  
000027

Reviewed \_\_\_\_\_

Date 6.8.04

pg **276946** a  
(cont. from pg **276945** b)

Paragon Analytics, Inc.

(cont. from pg 276a45 b)

Low Background Gas Flow Proportional Counter Log

Instrument: LB4100A

## *Instrument Background and Response Checklist*

P = passes; R = Recount; H = high;  
G = Good; N = No; P = poor.

\* See page 2769 45m for details check info

Dunlop

Form 780r6.frm (4/6/2001)

### Comments:

0000

Reviewed by

Date 6/2/09

SOP 724 Rev 8

Low Background Gas Flow Proportional Counter Log

Instrument: B4100A

Date: 6/7/04

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B  
 Counting Unit ID: Aqua  
 High Voltage Mode: Simultaneous  
 Application Revision: 2  
 Application Version: Standard  
 Rev.12/29/03 JE

Data File name: RAB0621  
 Batch ID: RA040816-1  
 Count Preset (m): 250  
 Batch Ended: 6/21/04 17:37

Det. ID	Sample ID	Count End	Date & Time	Alpha Activity			Beta Activity			Alpha Activity			Beta Activity			
				Count	Resid.	Resid.	Bkg.	b>a Xtalk	Base CPM	Gross CPM	Eff	Progeny Eff	Cor. Fact.	Gross CPM	Eff	Base CPM
A1	0405095-7	6/21/04 17:37	250.00	0.0	0.044	0.050	0.001	0.2722	1.246	n/a	n/a	1.886	1.276	0.0121	0.4204	
A2	0405095-8	6/21/04 17:37	250.00	0.0	0.140	0.105	0.002	0.2685	1.246	n/a	n/a	2.864	1.269	0.0384	0.4096	1.000
A3	RA040616-1NB	6/21/04 17:37	250.00	0.0	0.060	0.053	0.001	0.2700	1.246	n/a	n/a	1.432	1.352	0.0184	0.4183	1.000

Alpha Attenuation Calibration				Beta Attenuation Calibration			
$y = b'm^{-x}/(m^x \cdot x^{0.0})$				$y = b'm^{-x}/(m^x \cdot (mass=0))$			
Alpha b= 1.2450				Beta b= 1.0000			
m= 0.98400				m= 0.9999			
a= 1.0000				a= 1.0000			
x0= 0.0000				x0= 0.0000			
Alpha to Beta X-talk				Beta to Alpha X-talk			
$y = m \cdot b' \cdot mass$				$y = m \cdot mass \cdot b$			
a->b Xtalk m= 0.2740				b->a Xtalk m= -2.00E-06			
a->b Xtalk b= 1.0010				b->a Xtalk b= 0.0007			

000029

7/2  
6.25.04

## PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B  
 Counting Unit ID: Aqua  
 High Voltage Mode: Simultaneous  
 Application Revision: 2  
 Application Version: Standard  
 Rev. 1/22/2013 JE

Data file name: RAB0621A  
 Batch ID: RA040816-1  
 Count Preset (m): 60  
 Batch Ended: 6/21/04 14:27  
 Alpha efficiency logfile: AmWipe-04/04  
 Alpha attenuation calibration: ABA1103.XLS  
 Beta efficiency logfile: SR89-2004  
 Beta attenuation calibration: ABA1103.XLS

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = bmr^{\alpha}/(rmass^{\beta})$		$y = bmr^{\alpha}/(rmass^{\beta})$	
Alpha b=	1.24550	Beta b=	1.0000
m=	0.98400	m=	0.9999
a=	1.0089	n=	1.0000
x0=	0.0080	k0=	0.0000
Alpha to Beta X-talk		Beta to Alpha X-talk	
$y = bmr^{\alpha}/rmass^{\beta}$		$y = rmass^{\alpha}/b$	
a->b xtalk m=	0.2740	b->a xtalk m=	-2.00E-06
a->b xtalk b=	1.0010	b->a xtalk b=	0.0007

Det ID	Sample ID	Alpha Activity				Beta Activity				Progeny				Progeny			
		Count	End Date & Time	Resid.	Count	Bkg.	b->a xtalk	Base CPM	Base CPM	Gross CPM	Bkg. CPM	a->b xtalk	Base CPM	Base CPM	Cor.Fact.	Cor.Fact.	
A4	RA040816-1LCS	6/21/04 14:27	60.00	0.0	0.167	0.073	0.008	0.2701	1.246	11.483	1.363	0.0457	0.4252	1.000	n/a	n/a	
B3	RA040816-1LCSD	6/21/04 14:27	60.00	0.0	0.133	0.077	0.008	0.2717	1.246	11.683	1.424	0.0355	0.4337	1.000	n/a	n/a	

000030

22  
6.25.04

pg 276490 a  
 (cont. from pg N/A b)

## Paragon Analytics, Inc.

### Low Background Gas Flow Proportional Counter Log

#### Instrument: LB4100B

##### Instrument Background and Response Checklist

P-10 Supply	P-10 Flow	Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	On-line	Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	On-line
1	A O.1	1	✓	✓	✓	P										✓	R	P	P	✓	
2	B	2																P			-
	C	3																			
	D	4																			
<i>Bkg.</i>	<i>Cal. File ID</i>	5																			
Dr A	34C0618W	6																			
Dr B		7																			
Dr C		8																			
Dr D																					

P = passes; R = Recount; H = high; L = low; W = weekly;  $\alpha$  = Alpha; B = Beta; DR = Daily Response Check; Stat = Status; Det = Detector; Bkg = Background; OL = Offline; NP = Not Processed.

##### Runlog

Det	SnplID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Cmnt Below
1-6	DR Checks	-	-	EF0621	30	20:56	CCB	R	6-21-04	NP
1-6	Daily Bkg	-	-	BKB0621	60	10:29	CCB			
4	Daily Bkg	-	-	BKB0621A	60	11:55	R			
1	04 06 150-2	A80406150-2	A8	A8B0621	10	12:00	R			
2	-3									
3	-4									
4	-5									
7	-6									
8	-7									
13	-8									
14	-14									
1	-10									
2	-11									
3	-12									
4	-13									
7	-14D									

**Paragon Analytics, Inc.**  
**Low Background Gas Flow Proportional Counter Log**  
**Instrument: LB4100B**

b  
pg 276/90

6.21.04

Det	SmpID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Count Below
5	AB 06 150-15	AB040619-2	A3	AB30621A	10	1219	X	X	6.21.04	✓
13	-16									
14	-22									
1	-17									
:	-18									
3	-19									
4	-20									
7	-21									
8	-23									
13	+G640619-2 Acis									
14	-24Acis									
1	-2M6	AB040619-3		A330621C	1254					
2	04 06 150-24			AB30621D	1300					
3	-25									
4	-26									
7	-27									
8	-28									
9	AB040619-3Acis									
10	-3Acis									
11	-3mA			AB30621E	1321					
12	04 06 150-24 D			2430621	1325	X			6.22.04	
1	04 05 095-7	R4040616-1	R4228	2430621						
2	1	-8								
3	2 A040616-1m6			EA50621A	66	1326				
4	-16cs			EA50621A	1	1				
7	-16cs									

000032

Reviewed

X2 Date 6.22.04

## Paragon Analytics

## Radiochemistry ICP Worksheet

Prep Procedure: **Ra228**

Reviewed By: JRK **JR** Review Date: **6/9/04**

Prep Batch: **RA040602-1**

### Reference Carrier

LabID	QC Type	Carr Vol	Ref Carr Dil Vol	Ref Carr ICP Alq	Ref Carr ICP Dil Vol	Ref Carr ICP Run	Ref Carr ICP Conc
RA040602-1	CAR	2	1502	1	10	IR040607-1A1	2.32841

### Samples

Prep Num	LabID	QC Type	Init Samp Alq (ml)	Init Carr Vol (ml)	Init Samp Dil Vol (ml)	Init ICP Alq (ml)	Init ICP Dil Vol (ml)	Pre- Sep Vol (ml)	Post Con Vol (ml)	Post Sep Vol (ml)	Post Sep Vol (ml)	Final ICP Run	Init ICP Conc (ug/ml)	Fin ICP Conc (ug/ml)	Init Samp Mass (ug)	Ref Mass (ug)	Fin Samp Mass (ug)	% Yield	Final Sample Alq		
1	0405095-1	SMP	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040607-1A1	1.13011	0.48335	29269.85	34838.21	15%	28592.5	76.33%	2988
1	0405095-2	SMP	3000	2	31	0.1	100	30.9	30.9	55	0.1	100	IR040607-1A1	1.09027	0.48009	28096.44	34858.9	15%	26404.95	75.75%	2990
1	0405095-3	SMP	3000	2	36	0.1	100	35.9	35.9	55	0.1	100	IR040607-1A1	1.08051	0.47895	29061.41	34875.57	15%	26342.25	75.53%	2992
1	0405095-4	SMP	3000	2	36	0.1	100	35.9	35.9	55	0.1	100	IR040607-1A1	1.08088	0.47042	28751.59	34875.57	15%	25873.1	74.19%	2992
1	0405095-6	SMP	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040607-1A1	1.14197	0.47592	29877.03	34838.21	15%	26175.6	75.13%	2988
1	RA040602-1	MB	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040607-1A1	1.18758	0.4872	30758.32	34838.21	LB	26796	76.92%	2988
1	RA040602-1	LCS	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040607-1A1	1.21764	0.51546	31536.88	34838.21	LB	28350.3	81.35%	2988
1	RA040602-1	LCSD	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040607-1A1	1.23726	0.52143	32045.03	34838.21	LB	28678.65	82.32%	2988

### Reference Carrier

LabID	QC Type	Carr Vol	Ref Carr Dil Vol	Ref Carr ICP Alq	Ref Carr ICP Dil Vol	Ref Carr ICP Run	Ref Carr ICP Conc
RA040602-1	CAR	1	50	0.5	10	IR040609-1A1	8.33476

### Samples

Prep Num	LabID	QC Type	Init Samp Alq (ml)	Init Carr Vol (ml)	Init Samp Dil Vol (ml)	Init ICP Alq (ml)	Init ICP Dil Vol (ml)	Pre- Sep Vol (ml)	Post Con Vol (ml)	Post Sep Vol (ml)	Post Sep Vol (ml)	Final ICP Run	Init ICP Conc (ug/ml)	Fin ICP Conc (ug/ml)	Init Samp Mass (ug)	Ref Mass (ug)	Fin Samp Mass (ug)	% Yield	Final Sample Alq
1	0405095-1	SMP	3000	1	50	50	50	50	50	50	0.5	10	IR040609-1A1	0	6.82459	8334.76	6824.59	81.88%	NA
1	0405095-2	SMP	3000	1	50	50	50	50	50	50	0.5	10	IR040609-1A1	0	5.83261	8334.76	5832.61	69.98%	NA
1	0405095-3	SMP	3000	1	50	50	50	50	50	50	0.5	10	IR040609-1A1	0	5.94794	8334.76	5947.94	71.36%	NA
1	0405095-4	SMP	3000	1	50	50	50	50	50	50	0.5	10	IR040609-1A1	0	6.15327	8334.76	6153.27	73.83%	NA
1	0405095-6	SMP	3000	1	50	50	50	50	50	50	0.5	10	IR040609-1A1	0	6.15132	8334.76	6151.32	73.80%	NA
1	RA040602-1	MB	3000	1	50	50	50	50	50	50	0.5	10	IR040609-1A1	0	6.50551	8334.76	6505.1	78.05%	NA
1	RA040602-1	LCS	3000	1	50	50	50	50	50	50	0.5	10	IR040609-1A1	0	6.26315	8334.76	6233.15	75.14%	NA
1	RA040602-1	LCSD	3000	1	50	50	50	50	50	50	0.5	10	IR040609-1A1	0	6.51718	8334.76	6517.18	78.19%	NA

### BARIUM Recovery Results

### YTTRIUM Recovery Results

## Paragon Analytics

## Radiochemistry ICP Worksheet

Prep Batch: RA040602-1

Total Yield				
Prep Num	Lab ID	QC Type	Total Yield	
1	0405095-1	SMP	62.50%	
1	0405095-2	SMP	53.01%	
1	0405095-3	SMP	53.90%	
1	0405095-4	SMP	54.77%	
1	0405095-6	SMP	55.45%	
1	RA040602-1	MB	60.03%	
1	RA040602-1	LCS	61.15%	
1	RA040602-1	LCSD	64.37%	

0000

#	Sample Name	Y	Sr	Ba
1	CCB	-.00124	0	.00062
2	CCV	15.5819	62.7369	65.9119
3	CCV	9.9563	9.9466	9.9435
4	CCB	.00360	.00318	.00341
5	I 0405064-12	-.00040	1.0999	.01412
6	F 0405064-12	-.00160	.95119	.00142
7	I SR040601-2MB	-.00080	1.0590	.00028
8	F SR040601-2MB	-.00120	.87398	.00056
9	I SR040601-2LCS	-.00080	1.0705	-.00009
10	F SR040601-2LCS	.00000	.89540	.00056
11	I SR040601-2LCSD	-.00080	1.0661	.00000
12	F SR040601-2LCSD	.00000	.91473	.00056
13	SR040601-2RC	-.00080	1.0748	.00009
14	I 0405095-1	.00842	.35455	1.1301
15	CCV	9.8336	9.8831	9.8920
16	CCB	.00200	.00249	.00199
17	F 0405095-1	.01764	.09982	.48350
18	I 0405095-2	.00481	.28173	.90927
19	F 0405095-2	.01764	.09982	.48009
20	I 0405095-3	.00401	.23490	.80951
21	F 0405095-3	.01684	.08298	.47895
22	I 0405095-4	.00401	.23231	.80088
23	F 0405095-4	.01684	.08069	.47042
24	I 0405095-6	.00481	.37438	1.1420
25	F 0405095-6	.01684	.11028	.47592
26	I RA040602-1MB	.00721	.40924	1.1876
27	CCV	9.6266	9.6334	9.6137
28	CCB	.00401	.00398	.00293
29	F RA040602-1MB	.01684	.12781	.48720
30	I RA040602-1LCS	.00561	.40167	1.2176
31	F RA040602-1LCS	.01684	.12632	.51546
32	I RA040602-1LCSD	.00481	.35166	1.2373
33	F RA040602-1LCSD	.01764	.11526	.52143
34	RA040602-1RC	.00000	.00219	2.3284
35	Y 0405040-10	6.7417	.02849	.00540
36	Y 0405040-10D	6.9105	.01773	.00293
37	Y 0405040-11	6.6041	.00876	.00142
38	Y 0405175-1	6.7553	.00557	.00123
39	CCV	9.9900	10.047	10.026
40	CCB	.00481	.00547	.00464
41	Y 0405175-2	6.7750	.01046	.00274
42	Y RA040601-1MB	6.5207	.00956	.00180
43	Y RA040601-1LCS	6.4413	.00557	.00104
44	RA040601-1RC	8.7663	.00219	.00018
45	CCV	10.035	10.092	10.073
46	CCB	.00601	.00587	.00521

000035

#	Sample Name	Y	Sr	Ba
1	CCB	.00124	.00999	.01125
2	CCV	16.0425	64.0356	67.8737
3	CCV	9.9014	9.8724	9.8494
4	CCB	.00311	.00224	.00184
5	I 0405029-1	.00311	.52352	1.1924
6	F 0405029-1	.01558	.15013	.53076
7	I 0405029-2	.00311	.67385	1.2202
8	F 0405029-2	.01558	.19377	.51095
9	I 0405029-3	.00272	.57271	1.1200
10	F 0405029-3	.01558	.19357	.51980
11	I 0405029-4	.00155	.50429	1.1103
12	F 0405029-4	.01558	.14935	.46573
13	I 0405029-5	.00233	.53367	1.2303
14	F 0405029-5	.01324	.15999	.49714
15	CCV	9.8613	9.9156	9.8644
16	CCB	.00194	.00380	.00303
17	I 0405029-6	.00233	.48300	1.1739
18	F 0405029-6	.01480	.14183	.48351
19	I 0405029-7	-.00077	3.9650	.61162
20	F 0405029-7	.01597	1.6407	.52219
21	I 0405029-8	.00233	.49814	1.2644
22	F 0405029-8	.01597	.15716	.55056
23	I 0405029-9	-.00077	2.5689	.93166
24	F 0405029-9	.01402	1.3382	.59974
25	I 0405029-9D	.00155	2.7338	.94685
26	F 0405029-9D	.01480	1.4515	.59679
27	CCV	9.9521	10.037	9.9873
28	CCB	.00311	.00361	.00331
29	I 0405029-10	.00545	.68546	1.2976
30	F 0405029-10	.01792	.21417	.56612
31	I RA040603-1MB	.00857	.57672	1.3035
32	F RA040603-1MB	.01636	.17658	.53333
33	I RA040603-1LCS	.00779	.52937	1.2429
34	F RA040603-1LCS	.01714	.15843	.51998
35	RA040603-1RC	-.00311	.00068	2.2057
36	Y 0405095-1	6.8246	.01434	.00948
37	Y 0405095-2	5.8326	-.00078	-.00138
38	Y 0405095-3	5.9479	.02118	.01666
39	CCV	9.4584	9.5171	9.4270
40	CCB	.00311	.00458	.00377
41	Y 0405095-4	6.1533	.01093	.00571
42	Y 0405095-6	6.1513	-.00019	-.00110
43	Y RA040602-1MB	6.5051	.00156	-.00073
44	Y RA040602-1LCS	6.2632	-.00019	-.00110
45	Y RA040602-1LCSD	6.5172	.00292	.00055
46	RA040602-1RC	8.3348	-.00058	-.00156
47	I 0404185-1	.00779	1.6510	.44557
48	F 0404185-1	-.00311	1.0719	-.00036
49	I 0404185-2	.00272	1.8418	.59909
50	F 0404185-2	-.00194	.95840	-.00009
51	CCV	9.2488	9.3188	9.2304
52	CCB	.00311	.00458	.00313
53	I 0404185-3	.00506	2.5880	1.5541

000036

**Paragon Analytics****Radiochemistry ICP Worksheet**Prep Procedure: **Ra228**Reviewed By: JRK/*4*  
Review Date: **6/24/04****Reference Carrier**

LabID	QC Type	Carr Vol	Ref Carr Dil Vol	Ref Carr ICP Alq	Ref Carr ICP Dil Vol	Ref Carr ICP Run	Ref Carr ICP Conc
RA040616-1	CAR	2	1502	1	10	IR040621-1A1	1.92022

**Samples**

Prep Num	LabID	QC Type	Init Samp Alq (ml)	Car Samp Dil Vol (ml)	Init ICP Dil Vol (ml)	Post Con Vol (ml)	Pre Sep Vol (ml)	Post Sep Vol (ml)	Fin ICP Dil Vol (ml)	Fin ICP Dil Vol (ml)	Initial ICP Run	Final ICP Run	Init ICP Conc (ug/ml)	Fin ICP Conc (ug/ml)	Init Samp Mass (ug)	Fin Samp Mass (ug)	% Yield	Final Sample Alq	
1	0405095-7	SMP	3000	2	31	0.1	100	30.9	30.9	55	0.1	100	IR040621-1A1	0.9203	0.48766	28437.27	28748.67	LB	26821.3 93.30%
1	0405095-8	SMP	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040621-1A1	1.08826	0.47309	28185.93	28730.77	LB	26019.95 90.56%
1	RA040616-1	MB	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040621-1A1	1.07586	0.47514	27859.59	28730.77	LB	26132.7 90.96%
1	RA040616-1	LGS	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040621-1A1	1.08538	0.46486	27559.34	28730.77	LB	25567.3 88.99%
1	RA040616-1	LCSD	3000	2	26	0.1	100	25.9	25.9	55	0.1	100	IR040621-1A1	1.07052	0.52459	27726.47	28730.77	LB	28852.45 100.42%
																		2888	

**Reference Carrier**

LabID	QC Type	Carr Vol	Ref Carr Dil Vol	Ref Carr ICP Alq	Ref Carr ICP Dil Vol	Ref Carr ICP Run	Ref Carr ICP Conc
RA040616-1	CAR	1	50	0.5	10	IR040623-1A1	8.38006

**Samples**

Prep Num	LabID	QC Type	Init Samp Alq (ml)	Car Samp Dil Vol (ml)	Init ICP Dil Vol (ml)	Post Con Vol (ml)	Pre Sep Vol (ml)	Post Sep Vol (ml)	Fin ICP Dil Vol (ml)	Fin ICP Dil Vol (ml)	Initial ICP Run	Final ICP Run	Init ICP Conc (ug/ml)	Fin ICP Conc (ug/ml)	Init Samp Mass (ug)	Fin Samp Mass (ug)	% Yield	Final Sample Alq
1	0405095-7	SMP	3000	1	50	50	50	50	50	50	0.5	10	IR040623-1A1	0	6.24128	8380.061	6241.28	74.48%
1	0405095-8	SMP	3000	1	50	50	50	50	50	50	0.5	10	IR040623-1A1	0	5.42759	8380.061	5427.59	64.77%
1	RA040616-1	MB	3000	1	50	50	50	50	50	50	0.5	10	IR040623-1A1	0	6.11676	8380.061	6116.76	72.99%
1	RA040616-1	LGS	3000	1	50	50	50	50	50	50	0.5	10	IR040623-1A1	0	6.34505	8380.061	6345.05	75.72%
1	RA040616-1	LCSD	3000	1	50	50	50	50	50	50	0.5	10	IR040623-1A1	0	6.067782	8380.061	6067.82	72.41%

000  
Page 1 of 2  
Data Printed: 6/24/04 10:22Ra228 ICP Sheet  
Page 3  
Data Printed: 6/24/04 10:22

FLAG - LB: low bias (<= 15%) 15% low bias (>15%) M: Manual Entry  
 Superseded: *l/a*

Paragon Analytics  
 LIMS Version: 5.036A

**Paragon Analytics****Radiochemistry ICP Worksheet**

Prep Batch: RA040616-1

**Total Yield**

Prep Num	Lab ID	QC Type	Total Yield
1	0405095-7	SMP	69.48%
1	0405095-8	SMP	58.66%
1	RA040616-1	MB	66.39%
1	RA040616-1	LCS	67.38%
1	RA040616-1	LCSD	72.41%

0000

#	Sample Name	Y	Sr	Ba
1	CCB	-.00374	0	.00062
2	CCV	17.1894	68.9737	72.9381
3	CCV	9.9716	9.9497	9.9619
4	CCB	.00363	.00389	.00282
5	I 0405095-7	.00472	.26178	.92030
6	F 0405095-7	.01853	.10239	.48766
7	I 0405095-8	.00617	.34424	1.0883
8	F 0405095-8	.01890	.10529	.47309
9	I RA040616-1MB	.00799	.36508	1.0757
10	F RA040616-1MB	.01744	.11381	.47514
11	J RA040616-1LCS	.00727	.35955	1.0654
12	F RA040616-1LCS	.01672	.11625	.46486
13	I RA040616-1LCSD	.00799	.37360	1.0705
14	F RA040616-1LCSD	.01999	.12876	.52459
15	CCV	9.5525	9.5268	9.5054
16	CCB	.00617	.00534	.00539
17	RA040616-1RC	.00000	.00289	1.9202
18	Y 0405244-11	5.5062	.06714	.00985
19	Y 0405244-11D	4.6912	.05889	.01225
20	Y 0405244-12	4.8740	.03977	.01028
21	Y 0405244-13	5.1583	.16129	.02219
22	Y 0405244-14	4.9264	.14244	.01962
23	Y 0406017-1	4.8253	.03108	.01053
24	Y 0406017-2	4.8239	.02736	.00934
25	Y 0406017-3	5.2354	.03769	.01225
26	Y 0406017-4	5.6691	.03760	.00848
27	CCV	9.7303	9.6948	9.6574
28	CCB	.00617	.00489	.00488
29	Y 0406017-5	5.6676	.02229	.00368
30	Y RA040615-1MB	5.3270	.03307	.00719
31	Y RA040615-1LCS	4.9024	.03515	.01156
32	RA040615-1RC	7.6695	.00217	-.00008
33	I 0405203-1	.00436	.97219	.02844
34	F 0405203-1	.00000	.91311	.00051
35	I 0405203-2	.01017	.91547	.10008
36	F 0405203-2	.00000	.86917	.00197
37	I 0405203-3	.00218	.94139	.00771
38	F 0405203-3	.00109	.83718	.00051
39	CCV	9.4514	9.3695	9.3370
40	CCB	.00327	.00226	.00248
41	I 0405203-4	.00872	.88874	.13873
42	F 0405203-4	.00000	.82205	.00445
43	I 0405203-4D	.00945	.90976	.13667
44	F 0405203-4D	.00109	.82730	.00351
45	I 0405203-5	.00327	.95181	.05475
46	F 0405203-5	.00000	.90115	.00077
47	I 0405203-6	.00763	.96069	.18466
48	F 0405203-6	.00109	.90532	.00154
49	I 0405203-8	.00436	.97337	.03059
50	F 0405203-8	.00109	.89599	.00077
51	CCV	9.4242	9.3467	9.3128
52	CCB	.00727	.00652	.00608
53	I 0405203-9	.01126	.90324	.23718

000039

#	Sample Name	Y	Ba
1	CCB	0	.00562
2	CCV	15.9612	66.4256
3	CCV	9.9620	9.8967
4	CCB	.00274	.00207
5	I 0405244-1	-.00117	1.1449
6	F 0405244-1	.01605	.51697
7	I 0405244-1D	-.00039	1.1425
8	F 0405244-1D	.01566	.51622
9	I 0405244-2	.00000	.99132
10	F 0405244-2	.01605	.47773
11	I 0405244-3	.00078	1.1647
12	F 0405244-3	.01644	.52873
13	I 0405244-4	.00313	1.1535
14	F 0405244-4	.01566	.52864
15	CCV	10.111	10.052
16	CCB	.00313	.00385
17	I 0405244-5	.00626	1.1461
18	F 0405244-5	.01487	.52393
19	I 0405244-6	.00039	.67308
20	F 0405244-6	.01683	.50182
21	I 0405244-7	.00000	.83342
22	F 0405244-7	.01566	.53523
23	I 0405244-8	.00391	1.1521
24	F 0405244-8	.01566	.52685
25	I 0405244-9	.00000	.87454
26	F 0405244-9	.01566	.47528
27	CCV	10.158	10.102
28	CCB	.00469	.00470
29	I 0405244-10	.00000	1.1112
30	F 0405244-10	.01566	.61596
31	I RA040617-1MB	.00939	1.1174
32	F RA040617-1MB	.36024	.52544
33	I RA040617-1LCS	.00626	1.1497
34	F RA040617-1LCS	.01566	.53297
35	RA040617-1RC	-.00234	2.0397
36	Y 0405095-7	6.2413	.00771
37	Y 0405095-8	5.4276	.00988
38	Y RA040616-1MB	6.1168	.00724
39	CCV	9.9569	9.8686
40	CCB	.00234	.00254
41	Y RA040616-1LCS	6.3451	.00545
42	Y RA040616-1LCSD	6.0678	.00658
43	RA040616-1RC	8.3801	-.00065
44	I 0405030-7	.00509	.00065
45	F 0405030-7	-.00117	.56214
46	I 0405030-7D	.00000	.00122
47	F 0405030-7D	-.00234	.55423
48	I 0405085-1	-.00039	.00404
49	F 0405085-1	-.00234	.55988
50	I 0405085-2	.00000	.01336
51	CCV	9.9107	9.8324
52	CCB	.00391	.00385
53	F 0405085-2	-.00234	.52676

000040

**PARAGON ANALYTICS**  
**Radiochemistry Data Package**

Section 5

**QUALITY ASSURANCE**  
**SUMMARY REPORTS**

**5**

**000041**

## QUALITY ASSURANCE SUMMARY SHEET

PAI W.O. # / BATCH 0405095 / RA 144  
TEST 22%  
278601 METHOD Prep  
SOP/REV (PREP) 716 F7  
SOP/REV (ANAL)

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

- To achieve the requested Minimum Detection Limit of 0.5  $\mu\text{g}/\text{L}$ , an increased aliquot of 3 L was used.
- Due to limited sample volume, a sample duplicate was not prepared. A LCS duplicate was prepared instead.

TECHNICIAN/ANALYST



DATE 6/14/04

DEPARTMENT MANAGER



DATE 6/14/04

**PARAGON ANALYTICS**  
**Radiochemistry Data Package**

**Section 6**

**LABORATORY  
BENCH SHEETS**

**6**

**000043**

**Paragon Analytics****Radiochemistry Instrument Worksheet**

Prep Batch: RA040602-1

Prep Procedure: Ra228

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Analytical QASS / NCR? Y / N		
1	0405095-1	SMP	3000	2988.461	ml	RA040602-1	1	✓	-	-	-	-	-	-	-	✓	✓
1	0405095-2	SMP	3000	2990.323	ml			3									
1	0405095-3	SMP	3000	2991.667	ml			4									
1	0405095-4	SMP	3000	2991.667	ml			8									
1	0405095-6	SMP	3000	2988.461	ml			9									
1	RA040602-1	MB	3000	2988.461	ml			10									
1	RA040602-1	LCS	3000	2988.461	ml			11									
1	RA040602-1	LCSD	3000	2988.461	ml			12									✓

Tracer/Carrier/Solution Information						
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units
T1	BARIUM	247913	16.022.402	ppm	NA	2 ppm
T2	YTTRIUM	247915	9.000.839	ppm	NA	1 ppm

Spike Solution Information						
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units
S1	Ra-228	706.2613.32	59.396	DPM/ml	06/02/04	1 ml
						T-200

000  
24Page 1 of 1  
Ra228 Instrument Sheet  
Date Printed: 6/7/04 12:56

**Paragon Analytics****Radiochemistry Instrument Worksheet**

Prep Batch RA040616-1

Prep Procedure: Ra228

Analytical QASS / NCR? Y /  N / 

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Pos Chk By	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
1	0405095-7	SMP	3000	2990.323	ml	2430621	1	✓/2							
1	0405095-8	SMP	3000	2988.461	ml										
1	RA040616-1	MB	3000	2988.461	ml										
1	RA040616-1	LCS	3000	2988.461	ml	2430621A	4	✓/2							
1	RA040616-1	LCSD	3000	2988.461	ml										✓/D 6/28/01

## Tracer Carrier Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	YTTRIUM	247915	9,000	839	ppm	NA	1	ppm
T2	BARIUM	247918	16,023.189	ppm	NA	2	ppm	RS-011

## Strike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Ra-228				706.26	13.32	59.118	DPM/ml	06/16/04	1	ml

000

## Paragon Analytics

## Radiochemistry Prep Worksheet

Prep Batch: RA040602-1

Prep Procedure: Ra228

Reviewed By: JRK /4 Review Date: 6/9/04

Non-Routine Pre-Treatment? Y /N

Batch: 1A

Re-Prep? Y /N

Batch: N

Prep SOP: PAI 746 Rev: 7

Prep SOP: NONE

Matrix Class: liquid

Prep Analyst: Jeff Kujawa

Prep Date: 6/2/04

Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Ingrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-1	SMP	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2		
2	1	0405095-2	SMP	3000	2990.323	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2		
3	1	0405095-3	SMP	3000	2991.667	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2		
4	1	0405095-4	SMP	3000	2991.667	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2		
5	1	0405095-6	SMP	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2		
6	1	RA040602-1	MB	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2		
7	1	RA040602-1	LCS	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2,S1		
8	1	RA040602-1	LCSD	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2,S1		

Spiked By: Jeff Kujawa Date: 6/2/04 Yttrium Added By: Jeff Kujawa Date: 6/3/04 Relinquished By: \_\_\_\_\_

Witnessed By: Becky Kobiliska Date: 6/2/04 Witnessed By: Becky Kobiliska Date: 6/3/04 Received By: \_\_\_\_\_ Date: \_\_\_\_\_

Tracer/Carrier/Solution Information Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units	Pipet ID	Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units	Pipet ID
T1	BARIUM	247913	16,022.402	ppm	NA	2	RS-011	S1	Ra-228	708.2613.32	59.396	DPM/ml	06/02/04	1	ml T-200
T2	YTTRIUM	247915	9,000.839	ppm	NA	1	ppm								

Comments  
00000

## Paragon Analytics

## Radiochemistry Prep Worksheet

Prep Procedure: Ra228

Reviewed By: JRK/JL Review Date: 6/24/04

Non-Routine Pre-Treatment? Y / N Batch: 2A Re-Prep? Y / N Batch: 2A

Prep SOP: PAI 746 Rev: 7  
 Prep SOP: NONE  
 Matrix Class: liquid

Prep Analyst: Jeff Kujawa

Prep Date: 6/16/04  
 Prep Dept: RS

Prep QASS/NCR? Y / N 278601

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Ingrrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-7	SMP	3000	2990.323	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2		
2	1	0405095-8	SMP	3000	2998.461	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2		
3	1	RA040616-1	MB	3000	2998.461	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2		
4	1	RA040616-1	LCS	3000	2998.461	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2,S1		
5	1	RA040616-1	LCSD	3000	2998.461	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2,S1		

Spiked By: Jeff Kujawa Date: 6/16/04 Witnessed By: Nick Tisch Date: 6/16/04 Spike Solution Information											
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Soln #	Nuclide	SolnID	Prep Conc
T1	YTTRIUM	247915	9,000.839	ppm	NA	1	ppm	T-200	RA-228	706.2613.32	59.118
T2	BARIUM	247918	16,023.189	ppm	NA	2	ppm	RS-011			DPM/ml

Comments  
000

Page 1 of 1 Ra228 Bench Sheet Date Printed: 6/24/04 10:22

Paragon Analytics  
LIMS Version: 5.036A

Supersedes: 6/21/04 12:20

## Paragon Analytics

## Radiochemistry Prep Worksheet

Prep Batch: RA0410602

Prep Procedure: Ra228

## Prep Batch Not Validated!!!

Reviewed By:

Non-Routine Pre-Treatment? Y / N      Batch: \_\_\_\_\_

Re-Prep? Y / N      Batch: \_\_\_\_\_

Prep SOP: PAI 746

Rev: 7

Prep SOP: NONE

Matrix Class: liquid

Review Date:

Prep QASS / NCR? Y / N \_\_\_\_\_

Prep Analyst: Jeff Kujawa

Prep Date: 6/2/04

Prep Dept: RS

Balance:

Balance:

## Spiked By: Jeff Kujawa      Date: 6/2/04

Witnessed By: Becky Kobliska      Date: 6/2/04

Prep Notes

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Ingrrowth Date/Time	Decay Date/Time	Standards
1	1	0405095-1	SMP	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2	
2	1	0405095-2	SMP	3000	2980.323	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2	
3	1	0405095-3	SMP	3000	2991.667	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2	
4	1	0405095-4	SMP	3000	2991.667	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2	
5	1	0405095-6	SMP	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2	
6	1	RA040602-1	MB	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2	
7	1	RA040602-1	LCS	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2,S1	
8	1	RA040602-1	LCSD	3000	2988.461	Unfiltered	06/03/04 15:00	06/07/04 10:20	T1,T2,S1	

## Spiked By: Jeff Kujawa      Date: 6/2/04

Yttrium Added By: Jeff Kujawa

Witnessed By: Becky Kobliska      Date: 6/2/04

Relinquished By: *JL*

Date: 6/7/04

## Tracer/Carrier Solution Information

Received By: *LM*

Date: 6/7/04

## Spike Solution Information

Received By: *LM*

Date: 6/7/04

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
T1	BARIUM	247913	16.022.402	ppm	NA	2	ppm	RS-011
T2	YTTRIUM	247915	9.000.839	ppm	NA	1	ppm	T-200

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Ra-228		706.2613.32	ppm/ml	59.396	1	ml	T-200

DRAFT

Comments  
00000

**Paragon Analytics****Radiochemistry Prep Worksheet**

Prep Batch RA040602-1

Prep Procedure: Ra228

**Prep Batch Not Validated!!!**

Reviewed By:

Non-Routine Pre-Treatment? Y / N      Batch: \_\_\_\_\_

Prep SOP: PAI 746      Rev: 7

Prep SOP: NONE

Matrix Class: liquid

Re-Prep? Y / N      Batch: \_\_\_\_\_

Prep QASS / NCR? Y / N

Reviewed Date:

Prep Analyst: Jeff Kujawa JK  
Prep Date: 6/2/04  
Prep Dept: RSSpiked By: JKDate: 6/10/04Witnessed By: JKDate: 6/10/04

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aiq ml	Fin Aiq ml	Prep Basis	Ingrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-1	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
2	1	0405095-2	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
3	1	0405095-3	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
4	1	0405095-4	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
5	1	0405095-5	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
6	1	RA040602-1	MB	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
7	1	RA040602-1	LCS	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		
8	1	RA040602-1	LCSD	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aiq ml	Fin Aiq ml	Prep Basis	Ingrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-1	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
2	1	0405095-2	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
3	1	0405095-3	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
4	1	0405095-4	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
5	1	0405095-5	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
6	1	RA040602-1	MB	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
7	1	RA040602-1	LCS	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		
8	1	RA040602-1	LCSD	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aiq ml	Fin Aiq ml	Prep Basis	Ingrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-1	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
2	1	0405095-2	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
3	1	0405095-3	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
4	1	0405095-4	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
5	1	0405095-5	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
6	1	RA040602-1	MB	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
7	1	RA040602-1	LCS	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		
8	1	RA040602-1	LCSD	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aiq ml	Fin Aiq ml	Prep Basis	Ingrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-1	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
2	1	0405095-2	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
3	1	0405095-3	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
4	1	0405095-4	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
5	1	0405095-5	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
6	1	RA040602-1	MB	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
7	1	RA040602-1	LCS	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		
8	1	RA040602-1	LCSD	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aiq ml	Fin Aiq ml	Prep Basis	Ingrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-1	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
2	1	0405095-2	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
3	1	0405095-3	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
4	1	0405095-4	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
5	1	0405095-5	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
6	1	RA040602-1	MB	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
7	1	RA040602-1	LCS	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		
8	1	RA040602-1	LCSD	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aiq ml	Fin Aiq ml	Prep Basis	Ingrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-1	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
2	1	0405095-2	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
3	1	0405095-3	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
4	1	0405095-4	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
5	1	0405095-5	SMP	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
6	1	RA040602-1	MB	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2		
7	1	RA040602-1	LCS	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		
8	1	RA040602-1	LCSD	3000	3000	Unfiltered	1/3/04	6/13/04	T1,T2,SI		

Yttrium Added By: JK      Date: 6/13/04Witnessed By: JK      Date: 6/13/04Relinquished By: JK      Date: 6/13/04Received By: JK      Date: 6/13/04Initial TcP      Date: 6/13/04

095-2 @ 31ml

095-3.4 @ 36-2

095-4 @ 36-2

095-5 @ 36-2

095-6 @ 36-2

095-7 @ 36-2

095-8 @ 36-2

095-9 @ 36-2

095-10 @ 36-2

095-11 @ 36-2

095-12 @ 36-2

095-13 @ 36-2

095-14 @ 36-2

095-15 @ 36-2

095-16 @ 36-2

095-17 @ 36-2

095-18 @ 36-2

095-19 @ 36-2

095-20 @ 36-2

095-21 @ 36-2

095-22 @ 36-2

095-23 @ 36-2

095-24 @ 36-2

095-25 @ 36-2

095-26 @ 36-2

095-27 @ 36-2

095-28 @ 36-2

095-29 @ 36-2

095-30 @ 36-2

095-31 @ 36-2

095-32 @ 36-2

095-33 @ 36-2

095-34 @ 36-2

095-35 @ 36-2

095-36 @ 36-2

095-37 @ 36-2

095-38 @ 36-2

095-39 @ 36-2

095-40 @ 36-2

095-41 @ 36-2

095-42 @ 36-2

095-43 @ 36-2

095-44 @ 36-2

095-45 @ 36-2

095-46 @ 36-2

095-47 @ 36-2

095-48 @ 36-2

095-49 @ 36-2

095-50 @ 36-2

095-51 @ 36-2

095-52 @ 36-2

095-53 @ 36-2

095-54 @ 36-2

095-55 @ 36-2

095-56 @ 36-2

095-57 @ 36-2

095-58 @ 36-2

095-59 @ 36-2

095-60 @ 36-2

095-61 @ 36-2

095-62 @ 36-2

095-63 @ 36-2

095-64 @ 36-2

095-65 @ 36-2

095-66 @ 36-2

095-67 @ 36-2

095-68 @ 36-2

095-69 @ 36-2

095-70 @ 36-2

095-71 @ 36-2

095-72 @ 36-2

095-73 @ 36-2

095-74 @ 36-2

095-75 @ 36-2

**Paragon Analytics****Radiochemistry Prep Worksheet**

Prep Procedure: Ra228

**Prep Batch Not Validated!!!**

Reviewed By: \_\_\_\_\_

Review Date: \_\_\_\_\_

Non-Routine Pre-Treatment? Y / N Batch: \_\_\_\_\_

Prep SOP: PAI 746 Rev: 7

Prep SOP: NONE

Matrix Class: liquid

Prep Analyst: Jeff Kujawa

Prep Date: 6/16/04

Prep Dept: RS

Re-Prep? Y / N

Batch: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Review Date: \_\_\_\_\_

Samp Num	Prep LabID	QC Type	Dish No.	Init Aiq ml	Fin Aiq ml	Prep Basis Date/Time	Ingrowth Decay Date/Time	Standards	Prep Notes
1 1	0405095-7	SMP	3000	2980.323	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2	
2 1	0405095-8	SMP	3000	2988.461	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2	
3 1	RA040516-1	MB	3000	2988.461	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2	
4 1	RA040516-1	LCS	3000	2988.461	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2,S1	
5 1	RA040516-1	LCSD	3000	2988.461	Unfiltered	06/17/04 15:40	06/21/04 10:10	T1,T2,S1	

Spiked By: Jeff Kujawa Date: 6/16/04

Witnessed By: Nick Tisch Date: 6/16/04

**Tracer/Carrier Solution Information**

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
T1	YTTRIUM	247915	9,000.839	ppm	NA	1	ppm	T-200	
T2	BARIUM	247918	16,023.189	ppm	NA	2	ppm	RS-011	

Re-Prep? Y / N

Batch: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Review Date: \_\_\_\_\_

Splice Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Prep Date	Aliquot
S1	Ra-228		706.2813.32	59.118	DPM/ml	06/16/04	1 ml	T-200	

**DRAFT**

Reviewed By: \_\_\_\_\_

Review Date: \_\_\_\_\_

Comments: \_\_\_\_\_

Page 1 of 1 Ra228 Bench Sheet  
Date Printed: 6/21/04 12:20Paragon Analytics  
LIMS Version: 5.032A

Supersedes: 6/16/04 15:48

Prep Batch RA040516-1

## Paragon Analytics

## Radiochemistry Prep Worksheet

Prep Procedure: Ra228

## Prep Batch Not Validated!!!

Reviewed By: \_\_\_\_\_

Review Date: \_\_\_\_\_

Non-Routine Pre-Treatment? Y / N Batch: \_\_\_\_\_

Re-Prep? Y / N Batch: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Review Date: \_\_\_\_\_

Prep SOP: PAI 746 Rev: 7

Prep SOP: NONE

Matrix Class: liquid

Prep Analyst: Jeff Kujawa/JK  
Prep Date: 6/16/04  
Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq ml	Fin Aliq ml	Prep Basis	Ingrowth Date/Time	Decay Date/Time	Standards	Prep Notes
1	1	0405095-7	SMP	3000	3000	Unfiltered	6/17/04	6/21/04	T1,T2		
2	1	0405095-8	SMP	3000	3000	Unfiltered	15:40	10:10	T1,T2		
3	1	RA040616-1	MB	3000	3000	Unfiltered			T1,T2		
4	1	RA040616-1	LCS	3000	3000	Unfiltered			T1,T2,S1		
5	1	RA040616-1	LCSD	3000	3000	Unfiltered			T1,T2,S1		

Spiked By:	Date:	Yttrium Added By:	Date:	Yttrium Added By:	Date:										
JK	6/16/04	JK	6/17/04	JK	6/17/04										
Witnessed By:	JK	Witnessed By:	JK	Witnessed By:	JK										
Date:	6/16/04	Date:	6/17/04	Date:	6/17/04										
Tracer/Carrier Solution Information															
Soln #	Nuclide	SolnID	Prep Conc.	Units	Prep Date	Aliquot Units	Pipet ID	Soln ID	Nuclide	Prep Conc.	Units	Prep Date	Aliquot Units	Pipet ID	
T1	YTTRIUM	247915	9,000.839	ppm	NA	1	ppm	S1	Ra-228	706.2613.32	59.18	DPM/ml	06/16/04	1	ml
T2	BARIUM	247918	16,023.189	ppm	NA	2	ppm	RS-011							

DRAFT

Final TcP

All @ 55ml

Initial TcP

095-7 @ 31ml

Best &amp; Dowl

000 Comments

Page 1 of 1 Ra228 Bench Sheet

Date Printed: 6/16/04 15:48

## **SAMPLE CONDITION FORM (LIQUID)**

ANALYST: JRK

**ANALYSIS DATE:** 6/2004

METHOD: 228 fm

000052

## SAMPLE CONDITION FORM (LIQUID)

**ANALYST:** JRK

ANALYSIS DATE: 6/16/04

**METHOD:** 228 f

000053

**PARAGON ANALYTICS**  
**Radiochemistry Data Package**

**Section 7**

**STANDARDS  
TRACEABILITY  
DOCUMENTS**

**7**

**000054**

Prepare a working level spiking solution at approximately 30 pCi/mL by diluting 706.2613.22 with 0.8M HCl.

1) Determine the density of 0.8M HCl

Mass of empty class A 100mL volumetric flask	67.7972g	B1#13
Mass of flask + 100mL of 0.8M HCl	168.8065g	↓
Net mass of 0.8M HCl	101.0093g	

Lot # CW12/9/03  
X H613 X41A11

$$\rho = 1.010 \text{ g/mL}$$

2) Transfer std 706.2613.22 to a 1L nalgene bottle

Mass of 1L nalgene bottle w/o lid	74.8564g	B1#12
Mass of bottle + std	86.3776g	↓
Net mass of std.	11.5212g	

3) Dilute with 0.8M HCl to final volume

Mass of 1L nalgene bottle w/o lid from above	74.8564g	B1#12
mass of bottle, std, + 0.8M HCl	1093.4g	B1#26
Net mass of std + 0.8M HCl	1018.5g	

4) Final activity calculation

$$\frac{4045 \text{ dps} (60 \frac{\text{dpm}}{\text{dps}})(4.9127g)(11.5212g)(1.010 \text{ g/mL})}{(5.0255 \text{ g})(40.6515 \text{ g})(1018.5 \text{ g})} = 66.6079 \text{ dpm/mL}$$

Stnd ID: 706.2613.32

Description: Ra-228

Expiration: 12/9/04

Activity: 66.68 dpm/mL

2s Uncertainty: 2.07

dpm/mL

Ref. Date: 6/18/03

Ref Time: N/A

Prep Date: 12/9/03

Prep by: CW

Matrix/Comp. 0.8 M HCl

Half Life (y): 5.75E+00

Continued on Page

Read and Understood By

*Chad Wagner*

Signed

12/9/03  
Date

*Bennett Hollings*  
Signature

12/11/03

000055

PROJECT Ra 228 706.2613.22

Notebook No. 2615

Continued From Page

Dilute RSD # 706 with approximately 40 mL of  
0.8M HCl.

1) Determine the density of 0.8M HCl

$$\begin{array}{l} \text{Mass of empty class A 100mL volumetric flask} \quad 64.6065g \text{ Bal #12} \\ \text{Mass of flask + 100 mL of 0.8M HCl} \quad 165.4745g \\ \text{Net mass of 0.8M HCl} \quad 100.8689g \end{array}$$

Lot # 43099

$$P \text{ value} = 1.0086 \text{ g/mL}$$

2) Transfer contents of RSD # 706 to an empty 40mL VOR4 vial

$$\begin{array}{l} \text{mass of empty 40mL VOR4 vial w/o lid} \quad 21.8253g \text{ Bal #12} \\ \text{mass of open ampule + 50 mL beaker} \quad 36.6238g \\ \text{mass of empty ampule + 50 mL beaker} \quad 31.7106g \\ \text{Net mass of std. transferred.} \quad 4.9127g \end{array}$$

3) Final Dilution with 0.8M HCl

$$\begin{array}{l} \text{mass of vial from above} \quad 21.8253g \text{ Bal #12} \\ \text{mass of vial, std + 0.8M HCl} \quad 62.4768g \\ \text{Net mass of std + 0.8M HCl} \quad 40.6515g \end{array}$$

4) Final Activity Calculation

### ANALYTICS

1380 Seaboard Ind Blvd \* Atlanta, GA 30318 \* USA \* 404-352-8677

Ra-228

SRS 66337-307 Amount 0.109  $\mu$ Cl QA  $\mu$ Ci

Date 06/18/03 12:00 EST Exp. -----

PO # EW060603, Item 1

5.02556 g 0.8M HCl solution



CAUTION RADIOACTIVE MATERIAL

$$1045 \text{ DPS} \left( \frac{60 \text{ DPM}}{\text{DPS}} \right) \left( \frac{4.9127g}{40.6515g} \right) \left( 1.0086 \text{ g/mL} \right)$$

$$\left( 5.02556g \right) \left( 40.6515g \right)$$

$$= 5886.375 \text{ DPM/mL}$$

Continued on Page

Read and Understood By



8/18/03  
Date

  
Signature

12/11/03  
000056



ANALYTICS

1380 Seaboard Industrial Blvd.  
Atlanta, Georgia 30318 U.S.A.

Phone (404) 352-8677  
Fax (404) 352-2837

## CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

P&I ID 706  
rec'd 6-23-03

66337-307

Ra-228 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated using a germanium gamma spectrometer system.

Radionuclide purity and calibration were checked using a germanium gamma spectrometer system. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Ra-228
ACTIVITY (dps):	4.045 E3
HALF-LIFE:	5.75 years
CALIBRATION DATE:	June 18, 2003 12:00 EST
TOTAL UNCERTAINTY*:	3.1%

\*95% Confidence Level

Impurities: Ra-226 <0.1%  
 $\gamma$ -impurities (other than decay products) <0.1%

5.02556 grams 0.8M HCl solution with 20  $\mu$ g/g Ba carrier.

P O NUMBER EW060603, Item 1

SOURCE PREPARED BY: M. Taskaeva  
M. Taskaeva, Radiochemist

Q A APPROVED: Acadet 6/19/03

000057

**PARAGON ANALYTICS**  
**Radiochemistry Data Package**

**Section 8**

**CHAIN OF CUSTODY**

**8**

**000058**

# Paragon Analytics

## Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0405095

Client Name: Kent & Sullivan Inc.

Client Project Name: Ross Adams

Client Project Number:

Client PO Number:

Client Sample	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SW-01	0405095-1		WATER	05-May-04	16:40
SW-02	0405095-2		WATER	05-May-04	15:50
SW-04	0405095-3		WATER	04-May-04	17:52
SW-05	0405095-4		WATER	06-May-04	11:45
SW-06	0405095-5		WATER	06-May-04	8:50
SW-07	0405095-6		WATER	03-May-04	16:03
SW-08	0405095-7		WATER	03-May-04	16:59
SW-09	0405095-8		WATER	05-May-04	12:30
SW-10	0405095-9		WATER	05-May-04	14:57
SW-11	0405095-10		WATER	06-May-04	17:00
FR-01	0405095-11		WATER	06-May-04	8:00
FR-02	0405095-12		WATER	06-May-04	8:10



# Paragon Analytics, Inc.

225 Commerce Drive Fort Collins, CO 80524  
800-443-1511 or (970) 490-1522 Fax

## Chain-of-Custody

Accession Number (LAB ID)

Date \_\_\_\_\_

Page 1 of 9Project Name / No.: Koss Abdans Sampler(s): \_\_\_\_\_

Report To: SUE KENT  
 Phone: (970) 283-0949  
 Fax: (970) 283-0947  
 Company: KENT & SULLIVAN INC  
 Address: 53495 THUNDER RD  
KENAI AK 99611

Sample ID	Date	Time *	Lab ID	Matrix	No. of Containers	Comments: <small>circle method or specify under comments</small>	(circle one) Turnaround Standard or Rush (Due Date)		Dispose or Return to Client	
							Turnaround	Rush (Due Date)	Dispose	Return to Client
5/13/01 1640	1	5:00	5				X		X	
5/13/01 1550	2	5:	5				X		X	
5/14/01 1732	3	5:	5				X		X	
5/16/01 1145	4	8:	8				X		X	
5/16/01 0850	5	8:	5				X		X	
5/13/01 1613	6	8:	8				X		X	
5/13/01 1659	7	5:	5				X		X	
5/15/01 1230	8	5:	5				X		X	
5/15/01 1457	9	5:	5				X		X	
5/16/01 1700	10	5:	5				X		X	

Comments: <u>Reanalyzed sample</u>	(1) Reinquished By: <u>Sue Kent</u> Signature _____ Printed Name _____ Date <u>5/16/01</u> Time <u>10:00</u> Company <u>Kent &amp; Sullivan Inc</u>
	(2) Received By: <u>John</u> Signature _____ Printed Name _____ Date <u>5/16/01</u> Time <u>10:00</u> Company <u>Paragon Analytics</u>

Distribution: white / yellow (Paragon); pink retained by originator.

\*\* Indicate specific analytes under comments.

\* Time Zone (circle one): EST CST MST PST

Form 2024.xls (1/3/01)



Paragon Analytics, Inc.

225 Commerce Drive Fort Collins, CO 80524

800-443-1511 or (970) 490-1511 (970) 490-1522 Fax

Accession Number (LAB ID) 04C5095  
Date \_\_\_\_\_  
Page 2 of 4

## Chain-of-Custody

Project Name / No.:		Sampler(s):		(circle one) Turnaround: Standard or Rush (Due Date)				Dispose or Return to Client	
Report To:									
Phone:									
Fax:									
Company:									
Address:									
circle method or specify under comments									
Sample ID	Date	Time *	Matrix	No. of Contaminers	Lab ID				
FR01	5-6-04	0800	W	2	1				
FR02	5-6-04	0810	W	2	2				
MSD.01	5-6	1300	ED	2	3				
MSD.02	5-6	1310	ED	3	4				
MSD.03	5-6	0910	ED	2	5				
MSD.04	5-6	0910	ED	3	6				
MSD.05	5-6	0910	ED	3	7				
MSD.06	5-7	0910	ED	3	8				
MSD.07	5-7	0910	ED	3	9				
(B) Hold Samples Pending Meths results from Samples									
Comments: Hold Samples Pending Meths results from Samples									
(R) Hold Samples Pending Meths results from Samples									
(Y) On Hold (M) Meths Pending (P) Pending (L) Lab (T) Total									
* Time Zone (circle one): EST CST MST PST									
** Indicate specific analytes under comments.									
Distribution: white / yellow (Paragon); pink retained by originator.									

(2) Relinquished By:  
Signature \_\_\_\_\_ Printed Name \_\_\_\_\_  
Printed Name \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_  
Company \_\_\_\_\_

(1) Received By:  
Signature \_\_\_\_\_ Printed Name \_\_\_\_\_  
Printed Name \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_  
Company \_\_\_\_\_

(2) Received By:  
Signature \_\_\_\_\_ Printed Name \_\_\_\_\_  
Printed Name \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_  
Company \_\_\_\_\_

Form 2024.xls (1/3/01)  
Comments: Hold Samples Pending Meths results from Samples

MSD.01 5-6-04 0910

MSD.02 5-6-04 0910

MSD.03 5-6-04 0910

MSD.04 5-6-04 0910

MSD.05 5-6-04 0910

MSD.06 5-7-04 0910

MSD.07 5-7-04 0910

Comments: Hold Samples Pending Meths results from Samples

MSD.01 5-6-04 0910

MSD.02 5-6-04 0910

MSD.03 5-6-04 0910

MSD.04 5-6-04 0910

MSD.05 5-6-04 0910

MSD.06 5-7-04 0910

MSD.07 5-7-04 0910

## Paragon Analytics, Inc. -- Fort Collins, Colorado

## CONDITION OF SAMPLE UPON RECEIPT FORM

CLIENT: Kent + Sullivan WORKORDER NO: 0405095PROJECT MANAGER: Debbie Fazio INITIALS: DW DATE: 5/12/04

1. Does this project require any special handling in addition to standard Paragon procedures?	<input checked="" type="radio"/> Yes	No	
IS PRE-SCREENING REQUIRED? (radiochemistry, DOE, etc.)		<input checked="" type="radio"/> Yes	No
2. Are custody seals on shipping containers intact? How many custody seals are provided? <u>2 each</u>	N/A	<input checked="" type="radio"/> Yes	<input checked="" type="radio"/> No
3. Are the custody seals on sample containers intact?	(N/A)	<input checked="" type="radio"/> Yes	No
4. Is there a Chain-of-Custody (COC) or other representative documents, letters, or shipping memos?		<input checked="" type="radio"/> Yes	No
5. Is the COC complete? Relinquished: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Analyses Requested: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	N/A	<input checked="" type="radio"/> Yes	No
6. Is the COC in agreement with the samples received? No. of Samples: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Sample ID's: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Matrix: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> No. of Containers: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	N/A	<input checked="" type="radio"/> Yes	No
7. Were COC (if applicable) and sample labels legible?		<input checked="" type="radio"/> Yes	No
8. Were airbills present and/or removable?	N/A	<input checked="" type="radio"/> Yes	No
9. Are all aqueous samples requiring chemical preservation preserved correctly (excluding volatile organics)? Are all aqueous non-preserved samples at the correct pH?	N/A	<input checked="" type="radio"/> Yes	No
10. Is there enough sample for requested analyses? If so, were samples placed in the proper containers?		<input checked="" type="radio"/> Yes	No
11. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> Yes	No
12. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> Yes	No
13. Are samples requiring no headspace (volatiles, reactive cyanide/sulfide, radon), headspace free? Size of bubble: <u>&lt; green pea</u> ; <u>&gt; green pea</u> (List sample IDs and affected containers on Page 2)	(N/A)	<input checked="" type="radio"/> Yes	No
14. Were samples checked for and free from the presence of residual chlorine?	N/A	<input checked="" type="radio"/> Yes	No
15. Were the sample(s) shipped on ice?	N/A	<input checked="" type="radio"/> Yes	No
16. Were cooler temperatures measured at 0.1 - 6 °C? IR Gun Used*: <u>1/2</u>	N/A	<input checked="" type="radio"/> Yes	<input checked="" type="radio"/> No
17. Were all samples cooled that should have been cooled?	N/A	<input checked="" type="radio"/> Yes	<input checked="" type="radio"/> No

Cooler #'s 866 933 930 681 166 9 816 4  
 Temperature 10° 10° 15° 10° 12° 12° 14° 11° °C

Project Manager Signature / Date: Debbie Fazio 5/13/04

A NO RESPONSE TO ANY QUESTION EXCEPT #1 REQUIRES THE COMPLETION OF PAGE 2 OF THIS FORM

\* IR Gun #1 (original): Raytek, SN SC-PM3/T29403  
 IR Gun #2 (newer): Oakton, SN 2SCIR1201

## Paragon Analytics, Inc. -- Fort Collins, Colorado

## CONDITION OF SAMPLE UPON RECEIPT FORM

CLIENT: Kent + Sullivan WORKORDER NO: 0405095  
 PROJECT MANAGER: Debbie Fazzo INITIALS: D DATE: 5/12/04

- Custody seals broken (on outside of shipping container or on sample containers).
  - No Chain-of-Custody (COC) present.
  - Number of samples on the COC do not match the number of samples received.
  - Aqueous samples not preserved correctly (see pH discussion below).
  - SVOC samples contained residual chlorine (list sample IDs and affected containers below).
- Samples received at inappropriate temperature.
  - Insufficient sample to perform requested analyses.
  - Extraction or analytical holding times expired in transit.
  - Broken/leaking bottles and intact bottles received in same cooler (list affected sample IDs below).
  - No analyses requested.
  - Incorrect sample type received.
  - VOAs, reactive CN/S, radon not headspace free (list sample IDs and affected vials below).
  - Airbills not present and/or removable (record applicable shipper's tracking number below).
- Other (describe below).

Describe discrepancy:

- Sample #1 - #10: 500 ml poly bottles are labeled for alkalinity analysis and were received at pH 7. Labels list preservative as HNO<sub>3</sub>.
- Cooler #930 received with rear outside custody seal intact. Front custody seal was present but was not intact. All strapping tape was intact.
- All samples received between 10° - 15°C. Insufficient ice packed with samples. Refer to page 1 for cooler temperatures and refer to DOT page Survey pages for cooler contents.

Was the client contacted?  No;  Yes: Name Sue KENT Date/Time 5/13/04

Was the pH of any sample adjusted by the laboratory?  No;  Yes (see Table below):

NOTE: No pH adjustments shall be made without prior consent of Project Manager. After pH adjustment, hold metals and radchem samples ≥ 16 hr before analysis.

Sample ID	Initial pH	Final pH (wait 30 min)	Type of Reagent Used	Lot No. of Reagent Used	Initials / Date / Time

Was the laboratory directed to proceed with the analysis of any samples yielding the presence of residual chlorine?  No;  Yes (see notes above).

Project Manager Signature / Date: D 5/13/04

## SAMPLE LOGIN / DOT SURVEY

Client: Kent & SullivanWorkorder No: 0405095Project Manager: Debbie FazioInitials: AWDate: 5/12/04COOLER #: 866External Micro R Meter Reading ( $\mu$  R/hr): 50**Paragon Sample ID:**

0405095-6-5  
0405095-8-2  
0405095-8-3  
0405095-8-4  
0405095-8-5  
0405095-10-2  
0405095-10-3  
0405095-10-4

**Client Sample ID:**

SW-07  
SW-09  
SW-09  
SW-09  
SW-09  
SW-11  
SW-11  
SW-11

**Micro R Meter Reading ( $\mu$  R/hr):**

< background  
< background

COOLER #: 933External Micro R Meter Reading ( $\mu$  R/hr): 150**Paragon Sample ID:**

0405095-4-1  
0405095-4-4  
0405095-4-6  
0405095-4-7  
0405095-4-8

**Client Sample ID:**

SW-05  
SW-05  
SW-05  
SW-05  
SW-05

**Micro R Meter Reading ( $\mu$  R/hr):**

< background  
< background  
< background  
< background  
< background

COOLER #: 930External Micro R Meter Reading ( $\mu$  R/hr): 380**Paragon Sample ID:**

0405095-2-1  
0405095-2-2  
0405095-2-3  
0405095-6-8  
0405095-7-4  
0405095-7-5  
0405095-8-1  
0405095-9-3  
0405095-10-1

**Client Sample ID:**

SW-02  
SW-02  
SW-02  
SW-07  
SW-08  
SW-08  
SW-09  
SW-10  
SW-11

**Micro R Meter Reading ( $\mu$  R/hr):**

< background  
< background

If applicable, was the client contacted? YES / NO / NA Client Rep. Name: S. KentDate/Time: 5/13/04Project Manager Signature/ Date: D. Fazio 5/13/04

## SAMPLE LOGIN / DOT SURVEY

Client: Kent &amp; Sullivan

Workorder No: 0405095

Project Manager: Debbie Fazio

Initials: AW Date: 5/12/04

COOLER #: 681

External Micro R Meter Reading ( $\mu$  R/hr): 70**Paragon Sample ID:**

0405095-1-1  
0405095-1-2  
0405095-1-3  
0405095-1-4  
0405095-1-5  
0405095-3-2  
0405095-6-1  
0405095-9-1  
0405095-9-2  
0405095-9-5

**Client Sample ID:**

SW-01  
SW-01  
SW-01  
SW-01  
SW-01  
SW-04  
SW-07  
SW-10  
SW-10  
SW-10

**Micro R Meter Reading ( $\mu$  R/hr):**

< background  
< background

COOLER #: 166

External Micro R Meter Reading ( $\mu$  R/hr): 60**Paragon Sample ID:**

0405095-2-4  
0405095-2-5  
0405095-3-1  
0405095-3-3  
0405095-9-4  
0405095-11-1  
0405095-11-2  
0405095-12-1  
0405095-12-2

**Client Sample ID:**

SW-02  
SW-02  
SW-04  
SW-04  
SW-10  
FR-01  
FR-01  
FR-02  
FR-02

**Micro R Meter Reading ( $\mu$  R/hr):**

< background  
< background

COOLER #: 9

External Micro R Meter Reading ( $\mu$  R/hr): 80**Paragon Sample ID:**

0405095-3-4  
0405095-3-5  
0405095-4-2  
0405095-4-3  
0405095-4-5  
0405095-5-1  
0405095-5-2  
0405095-5-3  
0405095-5-5

**Client Sample ID:**

SW-04  
SW-04  
SW-05  
SW-05  
SW-05  
SW-05  
SW-06  
SW-06  
SW-06

**Micro R Meter Reading ( $\mu$  R/hr):**

< background  
< background

If applicable, was the client contacted? YES / NO / NA Client Rep. Name: S. Kent

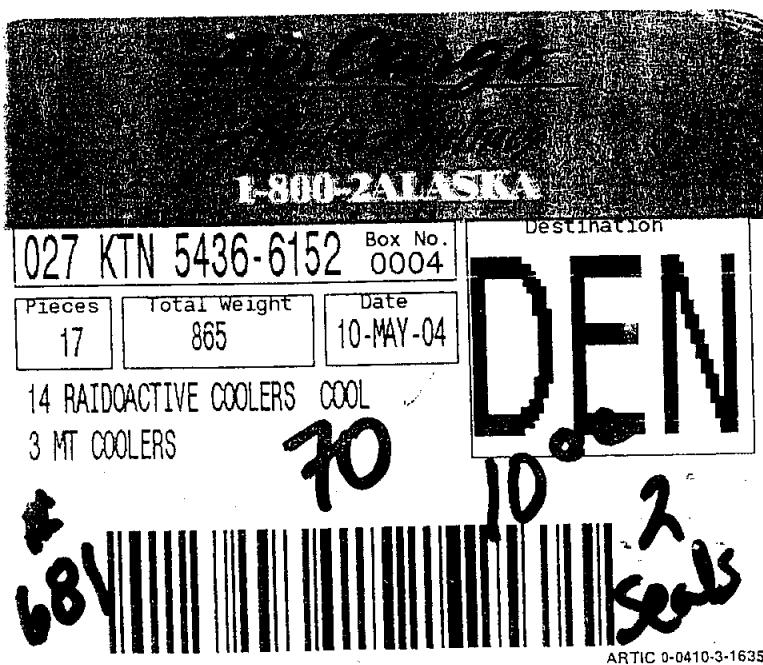
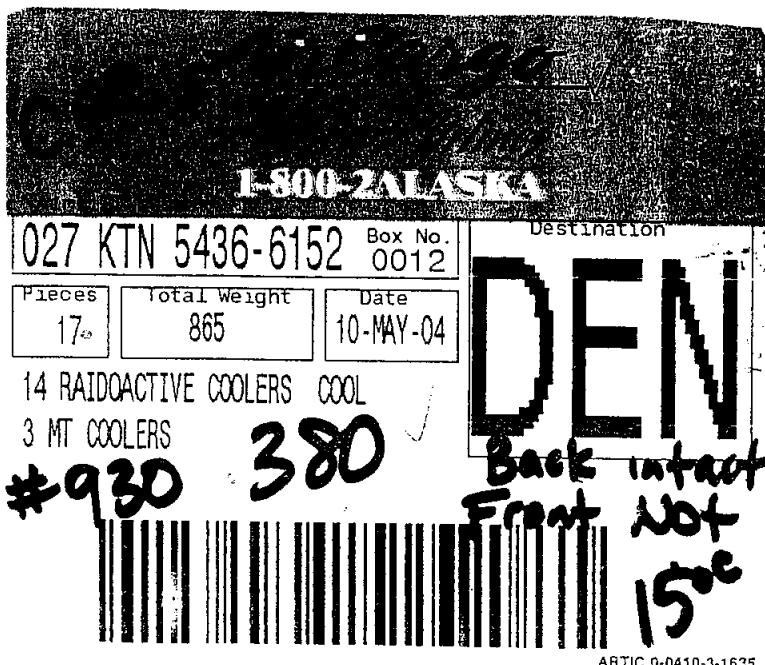
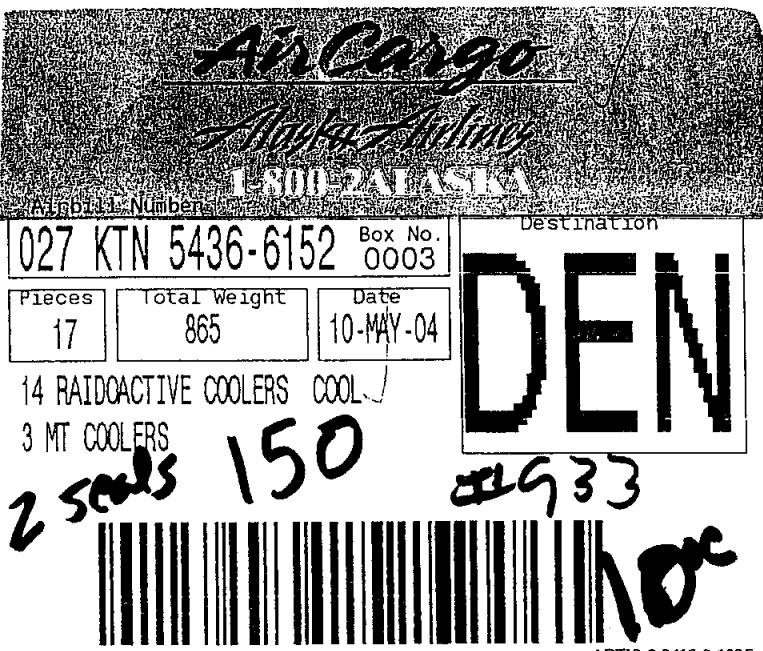
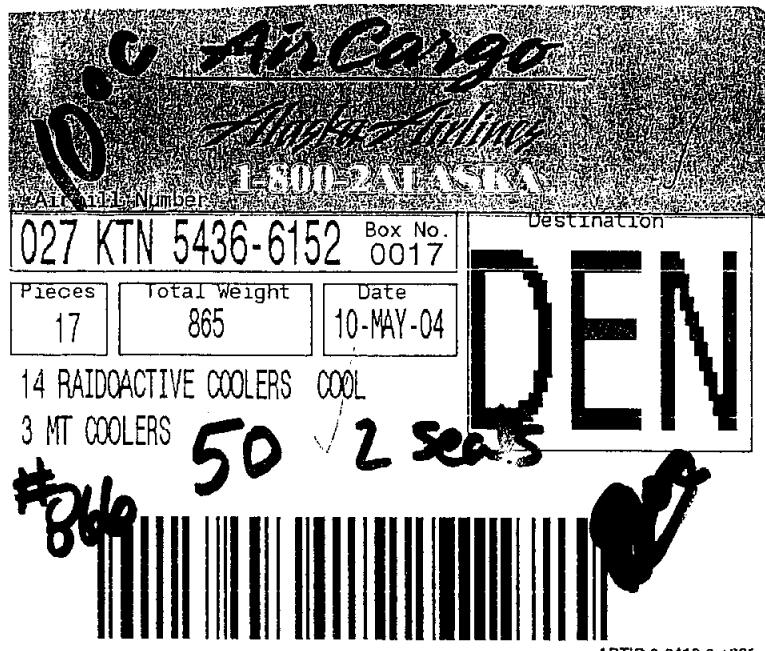
Date/Time: 5/13/04

Project Manager Signature/ Date: *S. Kent* 5/13/04

## SAMPLE LOGIN / DOT SURVEY

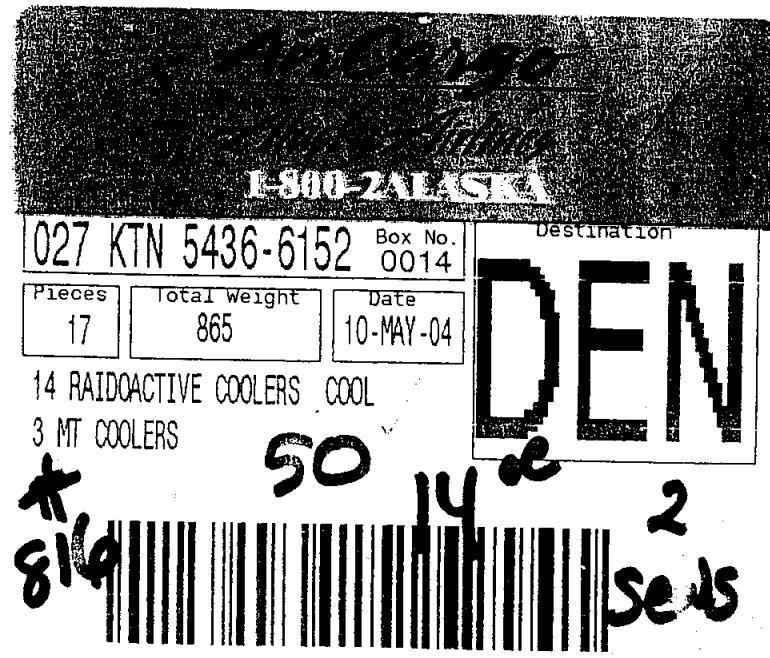
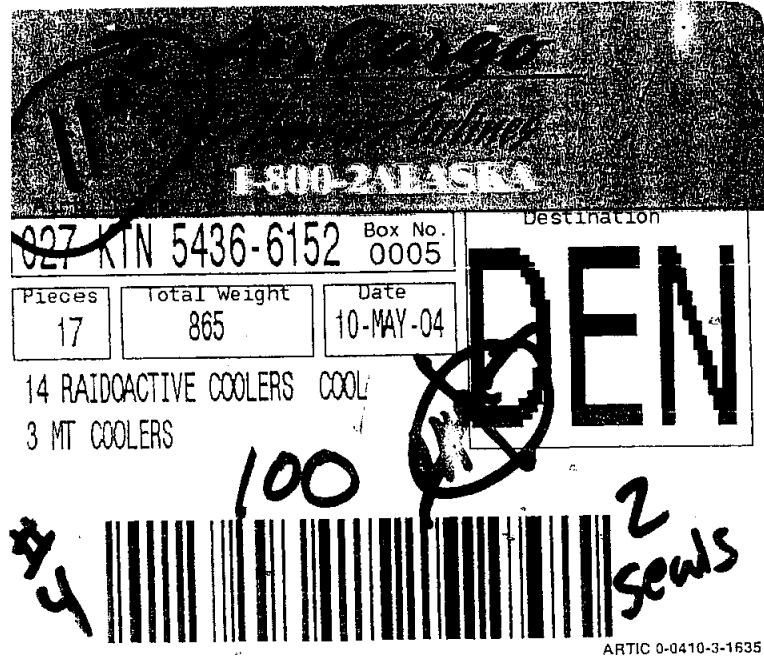
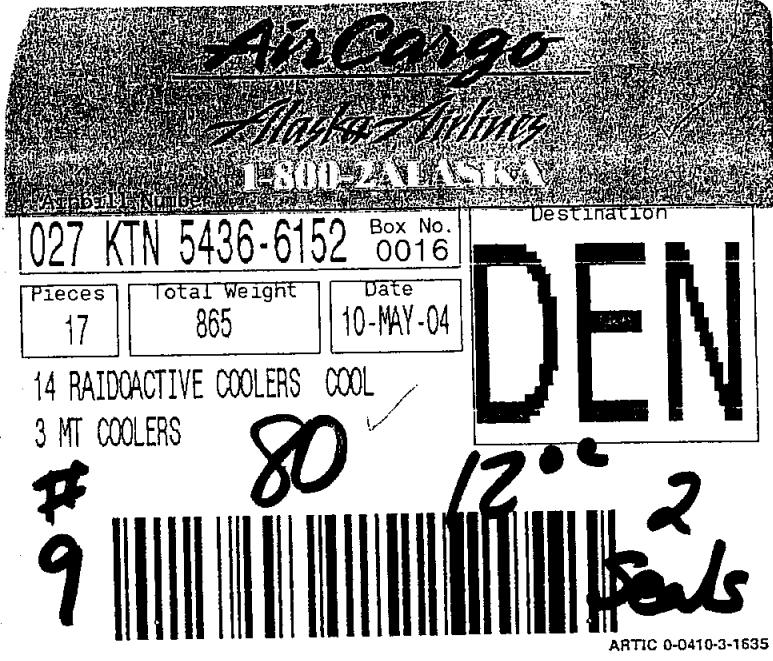
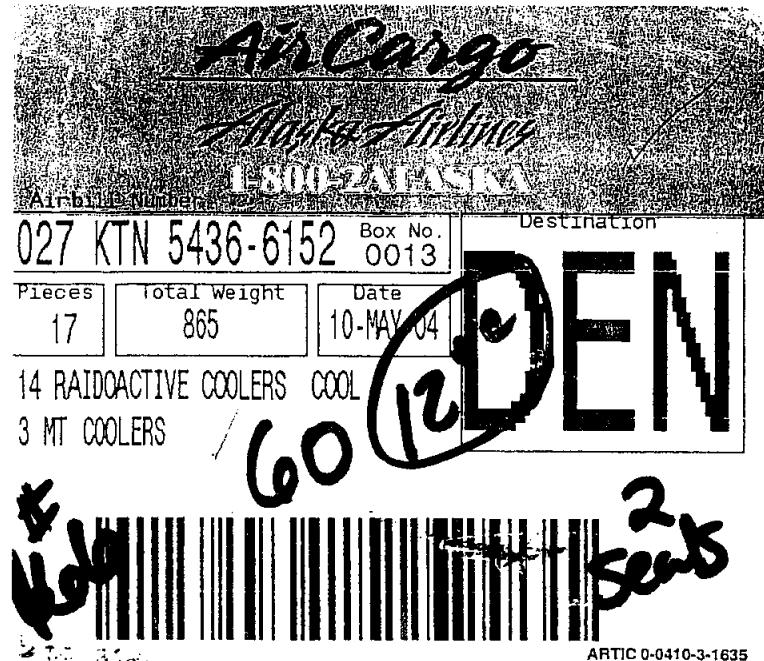
Client: Kent & SullivanWorkorder No: 0405095Project Manager: Debbie FazioInitials: AWDate: 5/12/04COOLER #: 816External Micro R Meter Reading ( $\mu$  R/hr): 50**Paragon Sample ID:**  
0405095-5-4**Client Sample ID:**  
SW-06**Micro R Meter Reading ( $\mu$  R/hr):**  
< backgroundCOOLER #: 4External Micro R Meter Reading ( $\mu$  R/hr): 100**Paragon Sample ID:**  
0405095-6-2  
0405095-6-3  
0405095-6-4  
0405095-6-6  
0405095-6-7  
0405095-7-1  
0405095-7-2  
0405095-7-3  
0405095-10-5**Client Sample ID:**  
SW-07  
SW-07  
SW-07  
SW-07  
SW-07  
SW-08  
SW-08  
SW-08  
SW-11**Micro R Meter Reading ( $\mu$  R/hr):**  
< background  
< backgroundIf applicable, was the client contacted? YES / NO / NA Client Rep. Name: Skiat Date/Time: 5/13/04Project Manager Signature/ Date: DJ 5/13/04

0405095



000067

0405095



000068

**PARAGON ANALYTICS  
Radiochemistry Data Package**

**Section 9**

**ADDITIONAL  
SUPPORTING  
DOCUMENTATION**

**9**

**000069**

# Gas Proportional Counter

Instrument Calibration

Background Calibration

**LB4100-A Weekly Instrument Calibration and Check**  
**Background Determinations**

Detector ID	CPM	Alpha		Flag	CPM	LCL	UCL	Flag	Detector ID
		LCL	UCL						
A1 (01)	0.130	0.098	0.253	PASS	2.132	2.125	2.556	PASS	A1 (01)
A2 (02)	0.084	0.045	0.140	PASS	3.514	1.420	2.659	FLAG-HIGH	A2 (02)
A3 (03)	0.097	0.052	0.176	PASS	2.015	1.793	2.380	PASS	A3 (03)
A4 (04)	0.096	0.025	0.200	PASS	1.974	1.1774	2.173	PASS	A4 (04)
B1 (05)	0.073	0.026	0.139	PASS	1.851	1.691	2.015	PASS	B1 (05)
B2 (06)	0.090	0.057	0.111	PASS	1.627	1.376	2.016	PASS	B2 (06)
B3 (07)	0.096	0.030	0.153	PASS	1.784	1.659	2.095	PASS	B3 (07)
B4 (08)	0.068	0.047	0.120	PASS	1.798	1.1649	1.952	PASS	B4 (08)
C1 (09)	0.071	0.035	0.168	PASS	1.702	1.466	2.042	PASS	C1 (09)
C2 (10)	0.059	0.027	0.174	PASS	1.706	1.584	2.013	PASS	C2 (10)
C3 (11)	0.085	0.047	0.148	PASS	1.711	1.517	2.028	PASS	C3 (11)
C4 (12)	0.082	0.023	0.188	PASS	1.905	1.628	2.272	PASS	C4 (12)
D1 (13)	#REF!	#REF!	#REF!	OFFLINE	#REF!	#REF!	#REF!	OFFLINE	D1 (13)
D2 (14)	#REF!	#REF!	#REF!	OFFLINE	#REF!	#REF!	#REF!	OFFLINE	D2 (14)
D3 (15)	#REF!	#REF!	#REF!	OFFLINE	#REF!	#REF!	#REF!	OFFLINE	D3 (15)
D4 (16)	#REF!	#REF!	#REF!	OFFLINE	#REF!	#REF!	#REF!	OFFLINE	D4 (16)

- detector 2 will be recounted in file YBKA0605W

Reviewed by: LCB

Date: 6/5/04

Control Limits set 4/16/04. CJ 4/16/04.

000071

**LB4100-A Weekly Instrument Calibration and Check**  
**Background Determinations**

Detector ID	Alpha CPM	Alpha LCL	Alpha UCL	Alpha Flag	Beta CPM	Beta LCL	Beta UCL	Beta Flag	Detector ID
A1 (01) #REF!	0.098	0.253	#REF!		2.125	2.556	#REF!		A1 (01)
A2 (02) #REF!	0.045	0.140	PASS		1.420	2.659	FLAG-HIGH		A2 (02)
A3 (03) #REF!	0.052	0.176	#REF!		1.793	2.380	#REF!		A3 (03)
A4 (04) #REF!	0.025	0.200	#REF!		1.774	2.173	#REF!		A4 (04)
B1 (05) #REF!	0.026	0.139	#REF!		1.691	2.015	#REF!		B1 (05)
B2 (06) #REF!	0.057	0.111	#REF!		1.376	2.016	#REF!		B2 (06)
B3 (07) #REF!	0.030	0.153	#REF!		1.659	2.095	#REF!		B3 (07)
B4 (08) #REF!	0.047	0.120	#REF!		1.649	1.952	#REF!		B4 (08)
C1 (09) #REF!	0.035	0.168	#REF!		1.466	2.042	#REF!		C1 (09)
C2 (10) #REF!	0.027	0.174	#REF!		1.584	2.013	#REF!		C2 (10)
C3 (11) #REF!	0.047	0.148	#REF!		1.517	2.028	#REF!		C3 (11)
C4 (12) #REF!	0.023	0.188	#REF!		1.628	2.272	#REF!		C4 (12)
D1 (13) #REF!	0.057	0.153	#REF!	OFFLINE	#REF!	#REF!	OFFLINE	D1 (13)	
D2 (14) #REF!	0.052	0.176	#REF!	OFFLINE	#REF!	#REF!	OFFLINE	D2 (14)	
D3 (15) #REF!	0.026	0.139	#REF!	OFFLINE	#REF!	#REF!	OFFLINE	D3 (15)	
D4 (16) #REF!	0.057	0.111	#REF!	OFFLINE	#REF!	#REF!	OFFLINE	D4 (16)	

-Detector 2 is offline  $\beta$  for the week

Reviewed by: LGB

Date: 6/17/04

Control Limits set 4/16/04. CJ 4/16/04.

**LB4100-B Weekly Instrument Calibration and Check**  
**Background Determinations**

Detector ID	Alpha			Beta			Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	
A1 (01)	0.050	0.044	0.150	PASS	1.276	1.244	1.486
A2 (02)	0.105	0.050	0.235	PASS	1.269	1.255	1.493
A3 (03)	-0.053	0.037	0.173	PASS	1.352	1.251	1.518
A4 (04)	0.073	0.001	0.193	PASS	1.363	1.225	1.540
B1 (05)	0.108	-0.0066	0.283	PASS	1.581	1.428	1.981
B2 (06)	0.079	0.008	0.247	PASS	1.452	1.339	1.770
B3 (07)	0.077	0.039	0.259	PASS	1.424	1.421	1.747
B4 (08)	0.094	-0.027	0.316	PASS	1.525	1.498	1.741
C1 (09)	0.098	0.046	0.174	PASS	1.500	1.324	1.754
C2 (10)	0.102	0.042	0.205	PASS	1.452	1.327	1.733
C3 (11)	0.111	0.0671	0.219	PASS	1.515	1.344	1.766
C4 (12)	0.083	-0.0123	0.216	PASS	1.450	1.338	1.726
D1 (13)	0.062	0.028	0.206	PASS	1.373	1.302	1.759
D2 (14)	0.071	0.017	0.207	PASS	1.715	1.730	2.319
D3 (15)	0.063	0.044	0.147	PASS	2.976	1.566	2.045
D4 (16)	0.074	0.022	0.206	PASS	3.901	1.405	2.033

- \* Detectors 5, 6, 15, & 16 are off-line beta for the week. JP 6/20/04
- Detector 14 will be recorded in file BKB0620W.

Reviewed by: JP

Date: 6/20/04

Control Limits set 1/26/04.  
CJ 1/26/04

**LB4100-B Weekly Instrument Calibration and Check**  
**Background Determinations**

Detector ID	Alpha			Beta			Detector ID	
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag
A1 (01) #REF!	0.044	0.150	#REF!	#REF!	1.244	1.486	#REF!	A1 (01)
A2 (02) #REF!	0.050	0.235	#REF!	#REF!	1.255	1.493	#REF!	A2 (02)
A3 (03) #REF!	0.037	0.173	#REF!	#REF!	1.251	1.518	#REF!	A3 (03)
A4 (04) #REF!	0.001	0.193	#REF!	#REF!	1.225	1.540	#REF!	A4 (04)
B1 (05) #REF!	-0.006	0.283	#REF!	#REF!	1.428	1.981	OFFLINE	B1 (05)
B2 (06) #REF!	0.008	0.247	#REF!	#REF!	1.339	1.770	OFFLINE	B2 (06)
B3 (07) #REF!	0.039	0.259	#REF!	#REF!	1.421	1.747	#REF!	B3 (07)
B4 (08) #REF!	-0.027	0.316	#REF!	#REF!	1.498	1.741	#REF!	B4 (08)
C1 (09) #REF!	0.046	0.174	#REF!	#REF!	1.324	1.754	#REF!	C1 (09)
C2 (10) #REF!	0.042	0.205	#REF!	#REF!	1.327	1.733	#REF!	C2 (10)
C3 (11) #REF!	0.067	0.219	#REF!	#REF!	1.344	1.766	#REF!	C3 (11)
C4 (12) #REF!	-0.012	0.216	#REF!	#REF!	1.338	1.726	#REF!	C4 (12)
D1 (13) #REF!	0.028	0.206	#REF!	#REF!	1.302	1.759	#REF!	D1 (13)
D2 (14) #REF!	0.083	0.017	0.207	PASS	1.768	1.730	PASS	D2 (14)
D3 (15) #REF!	0.044	0.147	#REF!	#REF!	1.566	2.045	#REF!	D3 (15)
D4 (16) #REF!	0.022	0.206	#REF!	#REF!	1.405	2.033	#REF!	D4 (16)

Reviewed by: ✓Z

Date: 6-21-04

Control Limits set 1/26/04.  
CJ 1/26/04

000074

Gas Proportional Counter

Quality Control Data

Daily Background Checks

000075  
000075

LB4100-A Daily Instrument Performance Checks  
Background Checks

Detector ID	Alpha			Beta			Detector ID	
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag
A1 (01)	0.200	-0.010	0.270	PASS	2.017	1.566	2.698	PASS
A2 (02)	0.050	-0.028	0.196	PASS	3.533	2.788	4.240	PASS
A3 (03)	0.167	-0.024	0.218	PASS	2.133	1.465	2.565	PASS
A4 (04)	0.200	-0.024	0.216	PASS	2.083	1.430	2.518	PASS
B1 (05)	0.117	-0.032	0.178	PASS	1.900	1.324	2.378	PASS
B2 (06)	0.083	-0.026	0.206	PASS	2.150	1.133	2.121	FLAG-HIGH
B3 (07)	0.100	-0.024	0.216	PASS	1.967	1.267	2.301	PASS
B4 (08)	0.117	-0.033	0.169	PASS	1.833	1.279	2.317	PASS
C1 (09)	0.033	-0.032	0.174	PASS	1.900	1.197	2.207	PASS
C2 (10)	0.117	-0.035	0.153	PASS	1.617	1.200	2.212	PASS
C3 (11)	0.117	-0.028	0.198	PASS	1.600	1.204	2.218	PASS
C4 (12)	0.083	-0.029	0.193	PASS	1.967	1.370	2.440	PASS
D1 (13)	#REF!	#REF!	OFFLINE	#REF!	#REF!	#REF!	OFFLINE	D1 (13)
D2 (14)	#REF!	#REF!	OFFLINE	#REF!	#REF!	#REF!	OFFLINE	D2 (14)
D3 (15)	#REF!	#REF!	OFFLINE	#REF!	#REF!	#REF!	OFFLINE	D3 (15)
D4 (16)	#REF!	#REF!	OFFLINE	#REF!	#REF!	#REF!	OFFLINE	D4 (16)

+Def 6 off 1.12

Reviewed by: F2

Date: 6/7/04

Control limits established from previous weekly background determinations.  
Weekly Background File: BK40604W Date: 6/4/04 Analyst: LGB

**LB4100-A Daily Instrument Performance Checks**  
**Background Checks**

Detector ID	Alpha			Beta			Detector ID	
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag
A1 (01)	0.067	-0.010	0.270	PASS	2.133	1.566	2.698	PASS
A2 (02)	0.050	-0.028	0.196	PASS	3.200	2.788	4.240	PASS
A3 (03)	0.033	-0.024	0.218	PASS	1.717	1.465	2.565	PASS
A4 (04)	0.150	-0.024	0.216	PASS	1.867	1.430	2.518	PASS
B1 (05)	0.083	-0.032	0.178	PASS	2.000	1.324	2.378	PASS
B2 (06)	0.083	-0.026	0.206	PASS	1.683	1.133	2.121	PASS
B3 (07)	0.033	-0.024	0.216	PASS	2.233	1.267	2.301	PASS
B4 (08)	0.100	-0.033	0.169	PASS	1.883	1.279	2.317	PASS
C1 (09)	0.050	-0.032	0.174	PASS	1.817	1.197	2.207	PASS
C2 (10)	0.067	-0.035	0.153	PASS	1.500	1.200	2.212	PASS
C3 (11)	0.050	-0.028	0.198	PASS	1.833	1.204	2.218	PASS
C4 (12)	0.067	-0.029	0.193	PASS	1.867	1.370	2.440	PASS
D1 (13)	#REF!	#REF!	#REF!	OFFLINE	#REF!	#REF!	OFFLINE	D1 (13)
D2 (14)	#REF!	#REF!	#REF!	OFFLINE	#REF!	#REF!	OFFLINE	D2 (14)
D3 (15)	#REF!	#REF!	#REF!	OFFLINE	#REF!	#REF!	OFFLINE	D3 (15)
D4 (16)	#REF!	#REF!	#REF!	OFFLINE	#REF!	#REF!	OFFLINE	D4 (16)

Reviewed by: ✓/2 Date: 6-6-04

Control limits established from previous weekly background determinations.  
 Weekly Background File: BK0604W Date: 6/4/04 Analyst: LGB

**LB4100-B Daily Instrument Performance Checks**  
**Background Checks**

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.067	-0.037	0.137	PASS	1.333	0.839	1.713	PASS	A1 (01)
A2 (02)	0.150	-0.020	0.230	PASS	1.167	0.833	1.705	PASS	A2 (02)
A3 (03)	0.000	-0.036	0.142	PASS	1.183	0.902	1.802	PASS	A3 (03)
A4 (04)	0.100	-0.032	0.178	PASS	1.183	0.911	1.815	PASS	A4 (04)
B1 (05)	0.167	-0.019	0.235	PASS	1.717	1.094	2.068	OFFLINE	B1 (05)
B2 (06)	0.150	-0.030	0.188	PASS	1.483	0.985	1.919	OFFLINE	B2 (06)
B3 (07)	0.083	-0.030	0.184	PASS	1.517	0.962	1.886	PASS	B3 (07)
B4 (08)	0.050	-0.025	0.213	PASS	1.467	1.047	2.003	PASS	B4 (08)
C1 (09)	0.100	-0.023	0.219	PASS	2.033	1.026	1.974	FLAG-HIGH	C1 (09)
C2 (10)	0.167	-0.022	0.226	PASS	1.200	0.985	1.919	PASS	C2 (10)
C3 (11)	0.133	-0.018	0.240	PASS	1.533	1.038	1.992	PASS	C3 (11)
C4 (12)	0.083	-0.029	0.195	PASS	1.233	0.984	1.916	PASS	C4 (12)
D1 (13)	0.100	-0.034	0.158	PASS	1.350	0.919	1.827	PASS	D1 (13)
D2 (14)	0.133	-0.032	0.174	PASS	2.133	1.208	2.222	PASS	D2 (14)
D3 (15)	0.033	-0.034	0.160	PASS	3.500	2.308	3.644	PASS	D3 (15)
D4 (16)	0.050	-0.031	0.179	PASS	4.333	3.136	4.666	PASS	D4 (16)

+ Recorded in *B6C6Z(A)*.

Reviewed by: \_\_\_\_\_

✓

Date: 6-2-04

Control limits established from previous weekly background determinations.  
 Weekly Background File: BK0618W Date: 6/18/04 Analyst: JP

**LB4100-B Daily Instrument Performance Checks**  
**Background Checks**

Detector ID	Alpha			Beta			Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	
A1 (01)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! A1 (01)
A2 (02)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! A2 (02)
A3 (03)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! A3 (03)
A4 (04)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! A4 (04)
B1 (05)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	OFFLINE B1 (05)
B2 (06)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	OFFLINE B2 (06)
B3 (07)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! B3 (07)
B4 (08)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! B4 (08)
C1 (09)	0.133	-0.023	0.219	PASS	1.767	1.026	1.974 PASS C1 (09)
C2 (10)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! C2 (10)
C3 (11)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! C3 (11)
C4 (12)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! C4 (12)
D1 (13)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! D1 (13)
D2 (14)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! D2 (14)
D3 (15)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! D3 (15)
D4 (16)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! D4 (16)

Reviewed by: ✓ 2

Date: 6-21-04

Control limits established from previous weekly background determinations.  
 Weekly Background File: BK0618W Date: 6/18/04 Analyst: JP

**LB4100-B Daily Instrument Performance Checks**  
**Background Checks**

Detector ID	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Beta	Detector ID
A1 (01)	0.067	-0.037	0.137	PASS	1.500	0.839	1.713	PASS	A1 (01)
A2 (02)	0.117	-0.020	0.230	PASS	1.617	0.833	1.705	PASS	A2 (02)
A3 (03)	0.067	-0.036	0.142	PASS	1.333	0.902	1.802	PASS	A3 (03)
A4 (04)	0.117	-0.032	0.178	PASS	1.300	0.911	1.815	PASS	A4 (04)
B1 (05)	0.117	-0.019	0.235	PASS	1.650	1.094	2.068	OFFLINE	B1 (05)
B2 (06)	0.083	-0.030	0.188	PASS	1.117	0.985	1.919	OFFLINE	B2 (06)
B3 (07)	0.067	-0.030	0.184	PASS	1.450	0.962	1.886	PASS	B3 (07)
B4 (08)	0.117	-0.025	0.213	PASS	1.567	1.047	2.003	PASS	B4 (08)
C1 (09)	0.150	-0.023	0.219	PASS	1.417	1.026	1.974	PASS	C1 (09)
C2 (10)	0.117	-0.022	0.226	PASS	1.917	0.985	1.919	PASS	C2 (10)
C3 (11)	0.067	-0.018	0.240	PASS	1.550	1.038	1.992	PASS	C3 (11)
C4 (12)	0.150	-0.029	0.195	PASS	1.700	0.984	1.916	PASS	C4 (12)
D1 (13)	0.067	-0.034	0.158	PASS	1.550	0.919	1.827	PASS	D1 (13)
D2 (14)	0.067	-0.029	0.195	PASS	1.783	1.253	2.283	PASS	D2 (14)
D3 (15)	0.033	-0.034	0.160	PASS	3.050	2.308	3.644	PASS	D3 (15)
D4 (16)	0.100	-0.031	0.179	PASS	3.950	3.136	4.666	PASS	D4 (16)

Reviewed by: ✓ 2

Date: 6.22-04

Control limits established from previous weekly background determinations.  
 Weekly Background File: BK0618W Date: 6/18/04 Analyst: JP

000080

Gas Proportional Counter  
Quality Control Data  
Daily Instrument Performance  
Checks

000081

**LB4100-A Daily Instrument Performance Check**  
**Efficiency Determinations**

Detector ID	Alpha			Beta			Detector ID	
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag
A1 (01)	0.2365	0.2085	0.2546	PASS	0.7982	0.7959	0.9352	PASS
A2 (02)	0.2258	0.2062	0.2574	PASS	0.8362	0.7892	0.9828	PASS
A3 (03)	0.2301	0.2062	0.2690	PASS	0.8498	0.7715	0.9888	PASS
A4 (04)	0.2200	0.1880	0.2528	PASS	0.8177	0.7382	0.9417	PASS
B1 (05)	0.2301	0.2257	0.2534	PASS	0.8455	0.8564	0.9214	FLAG-LOW
B2 (06)	0.2475	0.2387	0.2630	PASS	0.8878	0.9020	0.9548	FLAG-LOW
B3 (07)	0.2365	0.2186	0.2492	PASS	0.8500	0.8665	0.9156	FLAG-LOW
B4 (08)	0.2542	0.2435	0.2799	PASS	0.9364	0.9071	0.9634	PASS
C1 (09)	0.2635	0.2476	0.2862	PASS	0.8850	0.8520	0.9638	PASS
C2 (10)	0.2304	0.2133	0.2394	PASS	0.8431	0.8366	0.8885	PASS
C3 (11)	0.2403	0.2148	0.2570	PASS	0.8780	0.8661	0.9334	PASS
C4 (12)	0.2555	0.2402	0.2658	PASS	0.9305	0.8990	0.9597	PASS
D1 (13)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE
D2 (14)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE
D3 (15)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE
D4 (16)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE

Detectors 5, 6, 7 will be re-run in file EFA0607A

Reviewed by: CJ

Date: 6/7/04

Historical Control Limits established 03/03/04. CJ

000082

LB4100-A Daily Instrument Performance Check  
Efficiency Determinations

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01) #VALUE!	0.2085	0.2546	#VALUE!	#VALUE!	0.7959	0.9352	#VALUE!	A1 (01)	
A2 (02) #VALUE!	0.2062	0.2574	#VALUE!	#VALUE!	0.7892	0.9828	#VALUE!	A2 (02)	
A3 (03) #VALUE!	0.2062	0.2690	#VALUE!	#VALUE!	0.7715	0.9888	#VALUE!	A3 (03)	
A4 (04) #VALUE!	0.1880	0.2528	#VALUE!	#VALUE!	0.7382	0.9417	#VALUE!	A4 (04)	
B1 (05) 0.2553	0.2257	0.2534	FLAG-HIGH	0.9502	0.8564	0.9214	FLAG-HIGH	B1 (05)	
B2 (06) 0.2797	0.2387	0.2630	FLAG-HIGH	1.0625	0.9020	0.9548	FLAG-HIGH	B2 (06)	
B3 (07) 0.2701	0.2186	0.2492	FLAG-HIGH	1.0073	0.8665	0.9156	FLAG-HIGH	B3 (07)	
B4 (08) #VALUE!	0.2435	0.2799	#VALUE!	#VALUE!	0.9071	0.9634	#VALUE!	B4 (08)	
C1 (09) #VALUE!	0.2476	0.2862	#VALUE!	#VALUE!	0.8520	0.9638	#VALUE!	C1 (09)	
C2 (10) #VALUE!	0.2133	0.2394	#VALUE!	#VALUE!	0.8366	0.8885	#VALUE!	C2 (10)	
C3 (11) #VALUE!	0.2148	0.2570	#VALUE!	#VALUE!	0.8661	0.9334	#VALUE!	C3 (11)	
C4 (12) #VALUE!	0.2402	0.2658	#VALUE!	#VALUE!	0.8990	0.9597	#VALUE!	C4 (12)	
D1 (13) #VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D1 (13)	
D2 (14) #VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D2 (14)	
D3 (15) #VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D3 (15)	
D4 (16) #VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D4 (16)	

Detectors 5, 6, 7 will be re-run in file ZF-A6 GOTB

Reviewed by: CG

Date: 6/7/04

Historical Control Limits established 03/03/04. C.J

000083

LB4100-A Daily Instrument Performance Check  
Efficiency Determinations

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	#VALUE!	0.2085	0.2546	#VALUE!	#VALUE!	0.7959	0.9352	#VALUE!	A1 (01)
A2 (02)	#VALUE!	0.2062	0.2574	#VALUE!	#VALUE!	0.7892	0.9828	#VALUE!	A2 (02)
A3 (03)	#VALUE!	0.2062	0.2690	#VALUE!	#VALUE!	0.7715	0.9888	#VALUE!	A3 (03)
A4 (04)	#VALUE!	0.1880	0.2528	#VALUE!	#VALUE!	0.7382	0.9417	#VALUE!	A4 (04)
B1 (05)	0.2262	0.2257	0.2534	PASS	0.8031	0.8564	0.9214	FLAGLOW	B1 (05)
B2 (06)	0.2330	0.2387	0.2630	FLAGLOW	0.8360	0.9020	0.9548	FLAGLOW	B2 (06)
B3 (07)	0.2236	0.2186	0.2492	PASS	0.8421	0.8665	0.9156	FLAGLOW	B3 (07)
B4 (08)	#VALUE!	0.2435	0.2799	#VALUE!	#VALUE!	0.9071	0.9634	#VALUE!	B4 (08)
C1 (09)	#VALUE!	0.2476	0.2862	#VALUE!	#VALUE!	0.8520	0.9638	#VALUE!	C1 (09)
C2 (10)	#VALUE!	0.2133	0.2394	#VALUE!	#VALUE!	0.8366	0.8885	#VALUE!	C2 (10)
C3 (11)	#VALUE!	0.2148	0.2570	#VALUE!	#VALUE!	0.8661	0.9334	#VALUE!	C3 (11)
C4 (12)	#VALUE!	0.2402	0.2658	#VALUE!	#VALUE!	0.8990	0.9597	#VALUE!	C4 (12)
D1 (13)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D1 (13)
D2 (14)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D2 (14)
D3 (15)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D3 (15)
D4 (16)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D4 (16)

+ C2 line B 6/7/04

Reviewed by: 7-2

Date: 6/7/04

Historical Control Limits established 03/03/04. CJ

000084

**LB4100-A Daily Instrument Performance Check**  
**Efficiency Determinations**

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	#VALUE!	0.2085	0.2546	#VALUE!	#VALUE!	0.7959	0.9352	#VALUE!	A1 (01)
A2 (02)	#VALUE!	0.2062	0.2574	#VALUE!	#VALUE!	0.7892	0.9828	#VALUE!	A2 (02)
A3 (03)	#VALUE!	0.2062	0.2690	#VALUE!	#VALUE!	0.7715	0.9888	#VALUE!	A3 (03)
A4 (04)	#VALUE!	0.1880	0.2528	#VALUE!	#VALUE!	0.7382	0.9417	#VALUE!	A4 (04)
B1 (05)	0.2399	0.2257	0.2534	PASS	0.8588	0.8564	0.9214	PASS	B1 (05)
B2 (06)	0.2549	0.2387	0.2630	PASS	0.9101	0.9020	0.9548	PASS	B2 (06)
B3 (07)	0.2290	0.2186	0.2492	PASS	0.8895	0.8665	0.9156	PASS	B3 (07)
B4 (08)	0.2724	0.2435	0.2789	PASS	0.9177	0.9071	0.9634	PASS	B4 (08)
C1 (09)	#VALUE!	0.2476	0.2862	#VALUE!	#VALUE!	0.8520	0.9638	#VALUE!	C1 (09)
C2 (10)	#VALUE!	0.2133	0.2394	#VALUE!	#VALUE!	0.8366	0.8885	#VALUE!	C2 (10)
C3 (11)	#VALUE!	0.2148	0.2570	#VALUE!	#VALUE!	0.8661	0.9334	#VALUE!	C3 (11)
C4 (12)	#VALUE!	0.2402	0.2658	#VALUE!	#VALUE!	0.8990	0.9597	#VALUE!	C4 (12)
D1 (13)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D1 (13)
D2 (14)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D2 (14)
D3 (15)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D3 (15)
D4 (16)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D4 (16)

Det 5 → ) F9,1,2 6/7/04.

Reviewed by: ✓ ✓

Date: 6/7/04

Historical Control Limits established 03/03/04. C.J

000085

LB4100-A Daily Instrument Performance Check  
Efficiency Determinations

Detector	Alpha				Beta				Detector ID
	ID	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	
A1 (01)	0.2391	0.2085	0.2546	PASS	0.8199	0.7959	0.9352	PASS	A1 (01)
A2 (02)	0.2274	0.2062	0.2574	PASS	0.8667	0.7892	0.9828	PASS	A2 (02)
A3 (03)	0.2392	0.2062	0.2690	PASS	0.8897	0.7715	0.9888	PASS	A3 (03)
A4 (04)	0.2259	0.1880	0.2528	PASS	0.8367	0.7382	0.9417	PASS	A4 (04)
B1 (05)	0.2379	0.2257	0.2534	PASS	0.8633	0.8564	0.9214	PASS	B1 (05)
B2 (06)	0.2510	0.2387	0.2630	PASS	0.9139	0.9020	0.9548	PASS	B2 (06)
B3 (07)	0.2367	0.2186	0.2492	PASS	0.8713	0.8665	0.9156	PASS	B3 (07)
B4 (08)	0.2585	0.2435	0.2799	PASS	0.9247	0.9071	0.9634	PASS	B4 (08)
C1 (09)	0.2569	0.2476	0.2862	PASS	0.8650	0.8520	0.9638	PASS	C1 (09)
C2 (10)	0.2240	0.2133	0.2394	PASS	0.8502	0.8366	0.8835	PASS	C2 (10)
C3 (11)	0.2382	0.2148	0.2570	PASS	0.8697	0.8661	0.9334	PASS	C3 (11)
C4 (12)	0.2482	0.2402	0.2658	PASS	0.9287	0.8990	0.9597	PASS	C4 (12)
D1 (13)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D1 (13)
D2 (14)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D2 (14)
D3 (15)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D3 (15)
D4 (16)	#VALUE!	#VALUE!	#VALUE!	OFFLINE	#VALUE!	#VALUE!	#VALUE!	OFFLINE	D4 (16)

Reviewed by: J.J.

Date: 6-8-04

Historical Control Limits established 03/03/04. CJ

000086

**LB4100 - B**  
**Daily Instrument Performance Check**  
**Efficiency Determinations**

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	0.2392	0.2277	0.2583	PASS	0.8630	0.8448	0.8995	PASS	A1 (01)
A2 (02)	0.2401	0.2314	0.2605	PASS	0.8686	0.8428	0.8989	PASS	A2 (02)
A3 (03)	0.2386	0.2291	0.2588	PASS	0.8763	0.8661	0.9191	PASS	A3 (03)
A4 (04)	0.2473	0.2302	0.2602	PASS	0.8795	0.8514	0.9123	PASS	A4 (04)
B1 (05)	0.2472	0.2342	0.2646	PASS	0.9018	0.9050	0.9663	OFFLINE	B1 (05)
B2 (06)	0.2330	0.2219	0.2484	PASS	0.8653	0.8585	0.9286	OFFLINE	B2 (06)
B3 (07)	0.2551	0.2343	0.2656	PASS	0.9334	0.8782	0.9579	PASS	B3 (07)
B4 (08)	0.2500	0.2236	0.2616	PASS	0.8903	0.8623	0.9360	PASS	B4 (08)
C1 (09)	0.2661	0.2453	0.2752	PASS	0.9315	0.8863	0.9595	PASS	C1 (09)
C2 (10)	0.2550	0.2311	0.2644	PASS	0.8996	0.8750	0.9478	PASS	C2 (10)
C3 (11)	0.2558	0.2362	0.2674	PASS	0.9105	0.8588	0.9345	PASS	C3 (11)
C4 (12)	0.2409	0.2241	0.2531	PASS	0.8705	0.8415	0.9081	PASS	C4 (12)
D1 (13)	0.2467	0.2332	0.2660	PASS	0.9080	0.8681	0.9355	PASS	D1 (13)
D2 (14)	0.2509	0.2375	0.2664	PASS	0.9211	0.8713	0.9377	PASS	D2 (14)
D3 (15)	0.2519	0.2387	0.2733	PASS	0.8933	0.8858	0.9433	PASS	D3 (15)
D4 (16)	0.2510	0.2381	0.2666	PASS	0.9287	0.8823	0.9367	PASS	D4 (16)

Reviewed by: KZ

Date: 6-21-04

Control Limits established 12/21/03. JME

000087

**LB4100 - B**  
**Daily Instrument Performance Check**  
**Efficiency Determinations**

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	0.2469	0.2277	0.2583	PASS	0.8749	0.8448	0.8995	PASS	A1 (01)
A2 (02)	0.2452	0.2314	0.2605	PASS	0.8667	0.8428	0.8989	PASS	A2 (02)
A3 (03)	0.2449	0.2291	0.2588	PASS	0.8936	0.8661	0.9191	PASS	A3 (03)
A4 (04)	0.2475	0.2302	0.2602	PASS	0.8936	0.8514	0.9123	PASS	A4 (04)
B1 (05)	0.2417	0.2342	0.2646	PASS	0.8752	0.9050	0.9663	OFFLINE	B1 (05)
B2 (06)	0.2267	0.2219	0.2484	PASS	0.8480	0.8585	0.9286	OFFLINE	B2 (06)
B3 (07)	0.2429	0.2343	0.2656	PASS	0.9137	0.8782	0.9579	PASS	B3 (07)
B4 (08)	0.2450	0.2236	0.2616	PASS	0.8955	0.8623	0.9360	PASS	B4 (08)
C1 (09)	0.2526	0.2453	0.2752	PASS	0.9430	0.8863	0.9595	PASS	C1 (09)
C2 (10)	0.2426	0.2311	0.2644	PASS	0.9144	0.8750	0.9478	PASS	C2 (10)
C3 (11)	0.2418	0.2362	0.2674	PASS	0.8866	0.8588	0.9345	PASS	C3 (11)
C4 (12)	0.2374	0.2241	0.2531	PASS	0.8765	0.8415	0.9081	PASS	C4 (12)
D1 (13)	0.2442	0.2332	0.2660	PASS	0.9003	0.8681	0.9355	PASS	D1 (13)
D2 (14)	0.2574	0.2375	0.2664	PASS	0.9278	0.8713	0.9377	PASS	D2 (14)
D3 (15)	0.2523	0.2387	0.2733	PASS	0.8961	0.8858	0.9433	PASS	D3 (15)
D4 (16)	0.2492	0.2381	0.2666	PASS	0.9090	0.8823	0.9367	PASS	D4 (16)

Reviewed by: ✓

Date: 6-22-07

Control Limits established 12/21/03. JME

000083

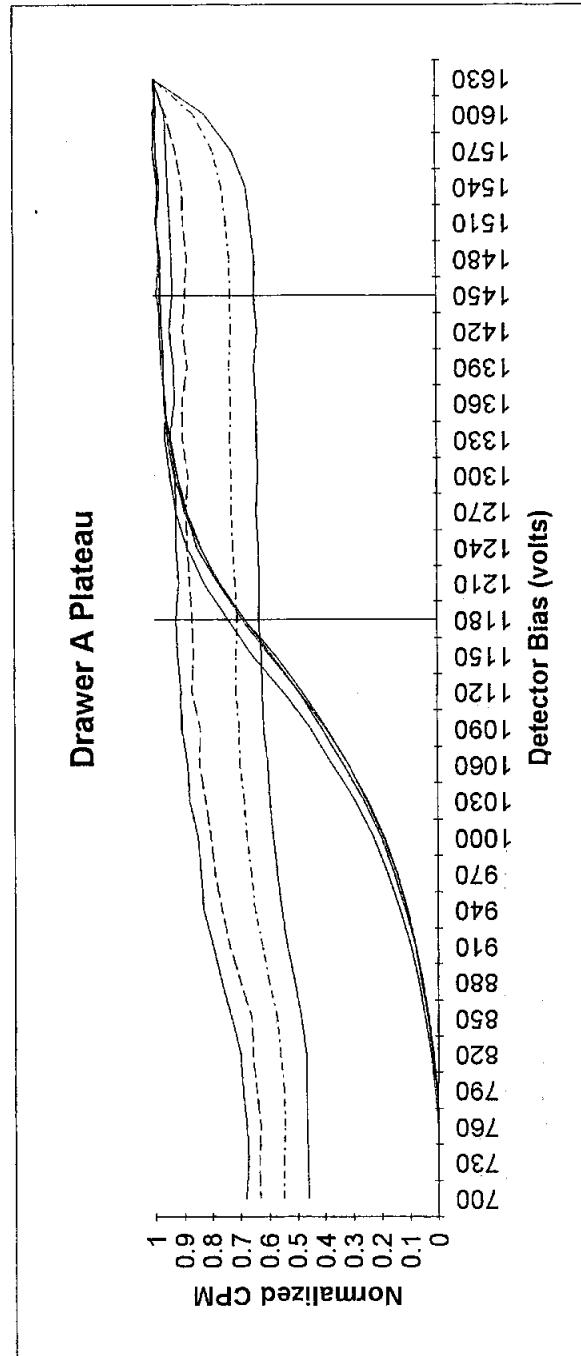
# Gas Proportional Counter

## Instrument Calibration

Initial Efficiency Calibration  
Standards Traceability

Unit Type: LB4100/W-A  
Date Performed: 1/29/04 08:56  
FileName: PTA0129A  
Batch ID: DRAWER A PLATEAU

Unit Id: Orange  
Application Revision: B  
Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

Optimum alpha only operating voltage:

	A1	A2	A3	A4
Beta slope at beta voltage	0.92%	1.77%	1.88%	2.16%
Alpha slope at beta voltage	0.56%	0.28%	1.54%	1.11%
Alpha slope at alpha voltage	1.02%	1.74%	1.52%	0.95%

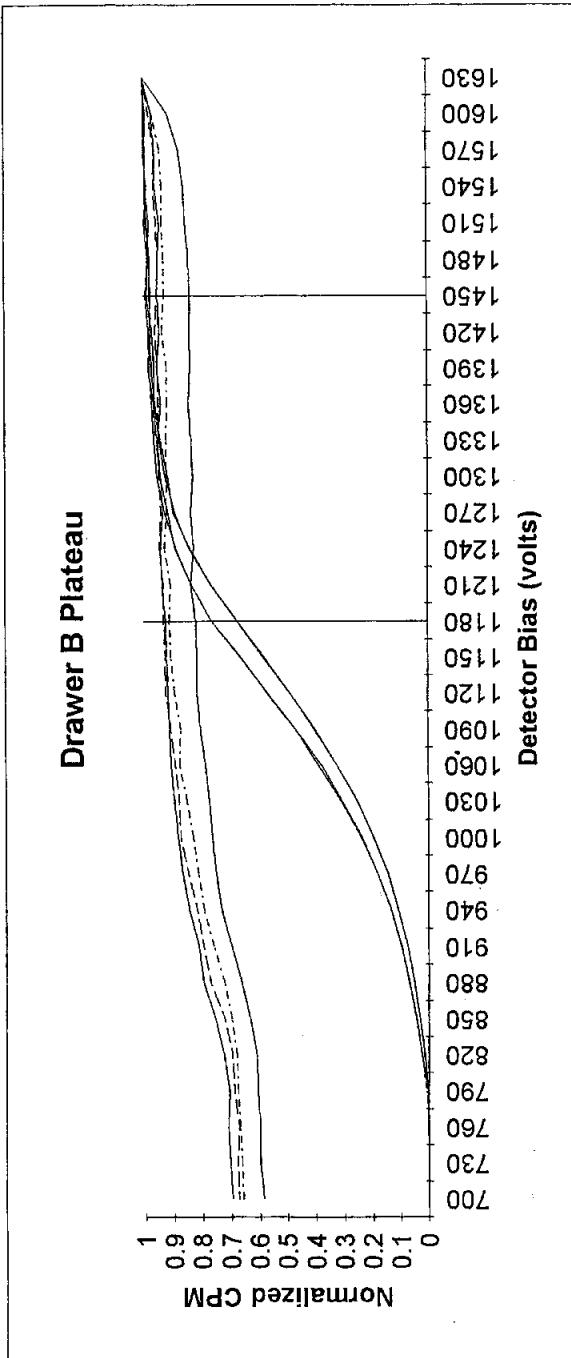
060000

Printed 1/29/04 3:23 PM

92/04

Unit Type: LB4100W-A  
Date Performed: 1/28/04 11:08  
FileName: PTA0128B  
Batch ID: DRAWER B PLATEAU

Unit Id: Orange  
Application Revision: B  
Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

Optimum alpha only operating voltage:

	B1	B2	B3	B4
Beta slope at beta voltage	1.14%	0.11%	0.85%	2.10%
Alpha slope at beta voltage	-0.54%	-0.10%	1.37%	0.88%
Alpha slope at alpha voltage	2.29%	1.61%	1.63%	2.40%

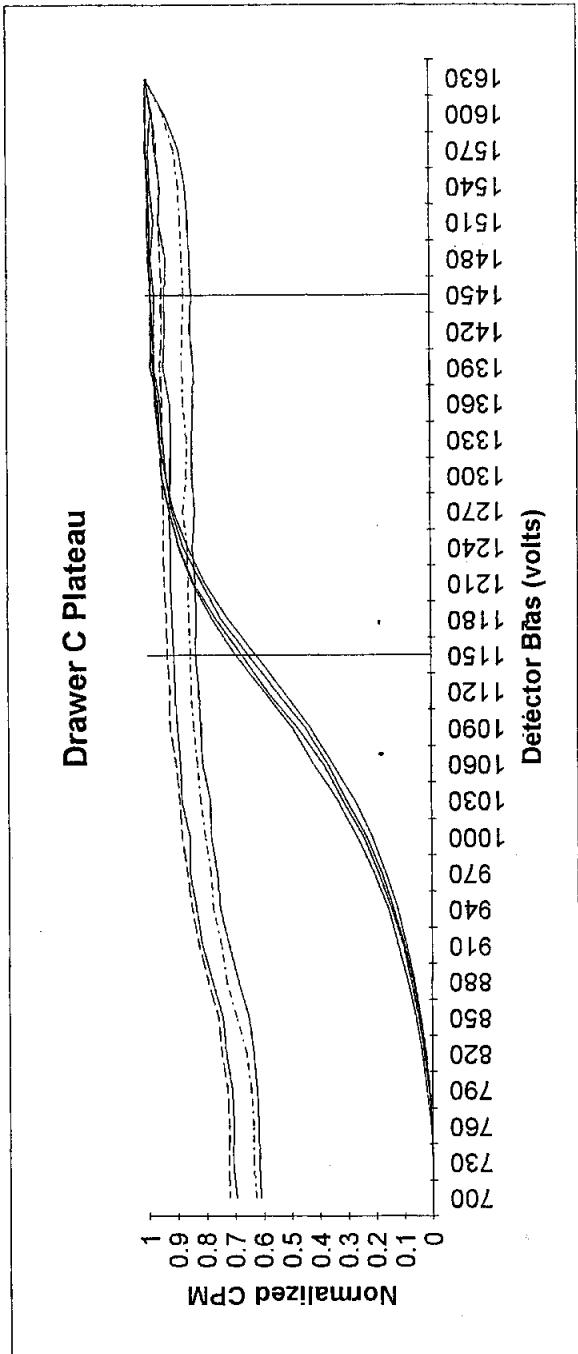
160000

Printed 1/29/04 9:05 AM

9/16/04

Unit Type: LB4100W-A  
Date Performed: 1/29/04 08:53  
FileName: PTA0129C  
Batch ID: DRAWER C PLATEAU

Unit Id: Orange  
Application Revision: B  
Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

Optimum alpha only operating voltage:

	C1	C2	C3	C4
Beta slope at beta voltage	0.35%	0.29%	1.43%	1.56%
Alpha slope at beta voltage	0.84%	0.49%	1.42%	0.53%
Alpha slope at alpha voltage	2.02%	1.76%	1.84%	1.77%

000002

9/2/04

Printed 1/29/04 3:25 PM

1/28/04 Plateaus are performed on Drawers A, B, C

Plateau parameters are:

Starting volts: 700

Count preset: 40,000

Ending volts: 1650

Weak count time: 10 min

10 Vts per step: 30

Weak count limit: 10

Count time per step: 5 min

Time between steps: 10 min

Filenames: PT0128 A A (data from this) PTAD29 C  
PT0128 B PTAD28 B PTAD29 A

Sources Used:

Det

Am291 - 410	1	3	9
411	2	4	10
412	5	7	9
413	6	8	10
			11
			12

Sr90 - 406	3	1	4
407	4	2	12
408	7	5	11
409	8	6	12
			10

Operating voltage:

Drawer A: ~~1447.5~~ 1447.5

Drawer B: 1447.5

Drawer C: 1447.5

1/30/04 Set ROI's on Drawers A, B, C

Source Used Det

Sr90/4-90 - 406	1	5	9
407	2	6	10
408	3	7	11
409	4	8	12

Continued on Page

Read and Understood By

Clare Lemire

Signed

2/10/04

Leah Ballo

Signed

2/10/04

000093

**LB4100-A Raw Counts for Sr-89 using Flat Planchets, Efficiency Calibration (Control ID 1124)**

Detector ID	A1 (01)	A2 (02)	A3 (03)	A4 (04)	B1 (05)	B2 (06)	B3 (07)	B4 (08)
total time	26.59	25.99	26.41	26.28	25.17	25.6	25.22	25.4
total counts	10004	10006	10000	10001	10005	10002	10000	10001
BKG counts	2.404	1.79	2.004	1.908	1.889	1.744	1.838	1.742
Beta CPM	373.8277	383.2042	376.6405	378.647556	395.608	388.9591	394.6727	391.998157
Beta Efficiency	0.406665	0.416865	0.409725	0.41190797	0.430538	0.423302	0.429521	0.42660986
archived STDEV	0.0211141	0.021668	0.021298	0.02141139	0.022379	0.022003	0.022326	0.02217462
Data file	ES89218A	ES89218A	ES89218A	ES89218A	ES89218B	ES89218B	ES89218B	ES89218B
Detector ID	C1 (09)	C2 (10)	C3 (11)	C4 (12)				
total time	25.93	25.6	25.36	25.62				
total counts	10003	10005	10007	10003				
BKG counts	1.64	1.738	1.78	1.928				
Beta CPM	384.1294	389.0823	392.8178	388.509158				
Beta Efficiency	0.418155	0.423547	0.427613	0.42292317				
archived STDEV	0.021735	0.022015	0.022227	0.02198376				
Data file	ES89218C	ES89218C	ES89218C	ES89218C				

8/6/13/04

## Sources

Source Database for OSUM for LB4100-A  
Number of sources in table: 103

Application Revision: A

Control ID	Isotope	Type	Half-Life (Days)	DPM	Std dev	Date	Status	Alpha/Beta Archive File
1120	Sr-90/Y-90	Beta	10511.61	22065.912	1103.30	18-Mar-99	PAI	Sr90R-02/04
1121	Am-241	Alpha	157856.78	11101.11	555.06	18-Mar-99	PAI	Am241R-02/04
1122	Sr-90/Y-90	Beta	10511.61	2206.59	110.33	18-Mar-99	PAI	Sr90F-02/04
1123	Th-230	Alpha	27539096	1980.14	99.01	2-Jul-02	PAI	Th230-02/04
1124	Sr-89	Beta	50.53	2256.7	112.84	15-Dec-03	PAI	Sr89-02/04
1125	Pb-210	Beta	8145.075	5938.01	296.90	18-Jun-03	PAI	Pb210-02/04

000095

2/18/04      Sr89 Calibration - Sr89 on print planchets

Benchsheet: 259500      Source ID: 1124  
 2/18/04      Sources: 0414022 - S1-S5      Log file: S189-02/04

Source: 0414022 - S1	Det:	A1 B1 C1
-S2		A2 B2 C2
-S4		A3 B3 C3
		A4 B4 C4
-S5		

Filenames: ES89.218A, ES89.218B, ES89.218C

2/18/04      Complete computer backup performed.  
 Filename: 2/18/04 LB4/100A

2/23/04 continued on Page \_\_\_\_\_

Read and Understood By

Carl Lencin

Signed

2/23/04

Date

X - FL

Signed

000096

Date

३८

cont. from pg N/A pg b) a

**Paragon Analytics, Inc.**  
Low Background Gas Flow Proportional Counter  
Instrument: **LB4100A**

# Paragon Analytics, Inc.

## Low Background Gas Flow Proportional Counter Log

SOP 724 Rev.

Date: 2/18/04

## *Instrument Background and Response Checklist*

P-10 Supply	P-10 Flow
1650	A G.i
2600	B

<i>Bkg.</i>	<i>Call File ID</i>
Dr A	010213\W
Dr B	↓
Dr C	
Dr D	NF

卷之三

P = passes; R = Recount, H = high; L = low; W = weekly;  $\alpha$  = Alpha; B = Beta; DR = Daily Response Check; Stat = Status; Det = Detector; Blkg = Background; OL = Offline; NP = Not Processed.

BRIEF

Form 780r6.srm (4/6/2001)

### Comments:

Form 780r6.srm (4/6/2001)

Reviewed by \_\_\_\_\_ Date 2/19/04

Source 1 P 1124 - A  
1131 - B

Paragon Analytics, Inc.

A  
659561

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES

Page 1 of 2  
Reviewed by / Date \_\_\_\_\_  
Form 798rJRM (5/12/2002)

Z5996)

B

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES / ACTINIDES

Initials <u>J</u>	Date <u>02/13/04</u>	Method (SOP / Rev) <u>KA</u>	Matrix <u>LURK</u>
COMMENTS			
<p><del>210 Pb</del> <del>Ba</del> <del>Ca</del> <del>88Sr</del> <del>137Cs</del> <del>137N</del></p> <p>89Sr Efficient Plauchets</p> <ul style="list-style-type: none"> <li>- PLAUCHETS SPICED &amp; CARRIER ADDED TO 5ml 16N HNO<sub>3</sub> ON PLAUCHET.</li> <li>- DRIED ON HOT PLATE</li> </ul>			

000099

PREPARE A WORKING LEVEL SPiking SOLUTION (APPROX. 1000 dpm/ml) OF  $^{89}\text{Sr}$  STANDARD BY DILUTING STANDARD 735.2613.35 WITH 0.1M HCl. HCl LOT #: 43268

### 1. DETERMINE THE DENSITY OF 0.1M HCl

$$\begin{aligned} \text{MASS OF EMPTY CLASS A VOLUMETRIC FLASK} &= 68.2952 \text{ g Bal} \\ \text{MASS OF FLASK + 100 mL 0.1M HCl} &= 168.0944 \text{ g Bal} \\ \text{NET MASS OF 0.1M HCl} &= 99.7992 \text{ g} \end{aligned}$$

$$\rho = 0.99803 \text{ g/mL}$$

### 2. TRANSFER STANDARD 735.2613.35 TO A 40mL VIAL

$$\begin{aligned} \text{MASS OF 40 mL VIAL w/o LD} &= 21.2212 \text{ g Bal} \\ \text{MASS OF VIAL + STANDARD} &= 21.6216 \text{ g} \\ \text{NET MASS OF STANDARD} &= 0.4004 \text{ g} \end{aligned}$$

### 3. ADD 0.1M HCl TO FINAL DILUTION

$$\begin{aligned} \text{MASS OF 40 mL VIAL w/o LD} &= 21.2212 \text{ g Bal} \\ \text{MASS OF VIAL + STANDARD + 0.1M HCl} &= 61.6746 \text{ g} \\ \text{NET MASS OF STD + 0.1M HCl} &= 40.4534 \text{ g} \end{aligned}$$

### 4. FINAL ACTIVITY CALCULATION

$$(114.729.104 \text{ dpm/g}) \times 0.4004 \text{ g} \times (0.99803 \text{ g/mL}) = 1128.35 \text{ dpm/mL}$$

Stnd ID: 735.2613.36

RG 2/19/04

REF DATE: 12/15/03, 12:00 EST

Description: Sr-89

Expiration: 2/11/05

Activity: 1128.35 dpm/mL

2s Uncertainty: 25.95 dpm/mL

Ref. Date: 12/15/03

Ref Time: N/A

Prep Date: 2/11/04 Prep by: AF

Matrix/Comp: 0.1 M HCl

Half Life (y): 1.38E-01

RG 2/19/04

Continued on Page

02/09/04

Read and Understood By

Date

Benedict Hollings

2/19/04  
000100

Signed

Signed

Date

PROJECT

735.2613.35 - Sr-89

Notebook No. 2613

35

Continued From Page

TRANSFER 50.1676g OF  $^{89}\text{Sr}$  STANDARD IN 0.1M HCl  
 TO 2 VOA VIALS. ( $^{89}\text{Sr} = 30\text{ g/g}$ )  
 SRS: 67308A-307

PAD# 735  
 8/21/04

VOA VIAL #1 TARE = 26.0978g  
 ↓ FINAL = 62.5504g  
36.4526g

Bal #12  
 ↓

VOA VIAL #2 TARE = 26.0640g  
 ↓ FINAL = 39.5676g  
13.5036g

Bal #12  
 ↓

### ACTIVITY CALCULATION

$$\frac{(9.55184)(60\text{ sec/min})}{(50.1676g)} = 114,229.104 \text{ dpm/g}$$

REF DATE: 12/15/03, 12:00 EST

Label Added After  
 "Z" out. RG 2/19/04

Stnd ID: 735.2613.35

Description: Sr-89

Expiration: 2/11/05

Activity: 114229.10 dpm/mL

2s Uncertainty: 2627.27 dpm/mL

Ref. Date: 12/15/03

Ref Time: N/A

Prep Date: 2/11/04

Prep by: AF

Matrix/Comp: 0.1 M HCl

Half Life (y): 1.38E-01

RG 2/19/04

Continued on Page

Signed

02/09/04

Date

Renee Hollings

Signed

2/19/04

000101

**CERTIFICATE OF CALIBRATION**

Standard Radionuclide Source

PAI JN 0735  
Recd 12-30-03

67308A-307

Sr-89 50 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Sr-89
ACTIVITY (dps):	9.551 E4
HALF-LIFE:	50.53 days
CALIBRATION DATE:	December 15, 2003 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	2.3%

Impurities:  $\gamma$ -impurities <0.1%

50.1676 grams 0.1M HCl solution with 30  $\mu$ g/g Sr carrier.

P O NUMBER EW120103, Item 1

SOURCE PREPARED BY: M. Taskaeva  
M. Taskaeva, Radiochemist

Q A APPROVED: W.M. Mitz 12-18-03

000102

New Standard Verification

WO# 0414016,0414019

Date 2/11/04

Date 2/10/04

WO:0414019

STD 735.2613.35	
Nuclide	Sr-89
Half Life	50.53 days
Init. Activity	114229.1 dpm/mL
Ref. Date	12/15/03
Vol.	0.100 mL
Current Spiked Act.	5155.19 dpm

WO:0414016

STD 735.2613.36	
Nuclide	Sr-89
Half Life	50.53 days
Init. Activity	1128.35 dpm/mL
Ref. Date	12/15/03
Vol.	1.0 mL
Current Spiked Act.	516.26 dpm

Background	
Sample ID	CPM
0414016-B1	1.650
0414019-B2	1.767

1.71 Ave. (Background used)

Standards	GCPM	BCPM	NCPM	% Yield	DPM Added	Eff.	Ave. Eff.	Calibrated	Calc DPM	Avg. DPM	2 StdDev	Obs w/in 5% Cert. Value 2 sig < 10%
Sample ID								Efficiency				of Cert. w/in 2sig of mean
0414019-S1	2169.07	1.71	2167.36	100%	5155.19	0.4204	0.4203	0.4203	0.4203	0.4203	0.4203	(ICPT Req.) (ICPT Req.) (P/N Req.)
0414019-S2	2165.50	1.71	2163.79	100%	5155.19	0.4197	0.4203	0.4203	0.4203	0.4203	0.4203	
0414019-S3	2171.50	1.71	2169.74	100%	5155.19	0.4209	0.4203	0.4203	0.4203	0.4203	0.4203	
0414016-S1	218.45	1.71	216.74	100%	516.26	0.4198	0.4198	0.4198	0.4198	0.4198	0.4198	
0414016-S2	213.40	1.71	211.69	100%	516.26	0.4100	0.4100	0.4100	0.4100	0.4100	0.4100	
0414016-S3	218.75	1.71	217.04	100%	516.26	0.4204	0.4163	0.4203	0.4203	0.4203	0.4203	

r:\marta\fp\14019v.xls

DL  
RC  
2/11/04

000103

Paragon Analytics, Inc.

QUALITY ASSURANCE SUMMARY SHEET

PAI W.O. # / BATCH Sr-89 Verification  
TEST Sr-89

**263234**

METHOD 100%

SOP/REV (PREP) -

SOP/REV (ANAL) 724R8

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

In the absence of a second source for Sr-89, Standard 735.2613.35 (parent) is verified against 735.2613.36, a dilution of 735.2613.35. Standard 735.2613.35 is NIST traceable and was prepared by transferring Std ID 735 to rot vials. 735.2613.36 was diluted and prepared as stated in standards logbook. X

RG  
2/12/04

TECHNICIAN/ANALYST Clau Zenin

DATE 2/11/04

DEPARTMENT MANAGER Bruce Hollings

DATE 2/12/04

PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B  
 Counting Unit ID: Aqua  
 High Voltage Mode: Simultaneous  
 Application Revision:  
 Application Version: Standard  
 Rev.: 12/29/03 J/E

Background logfile: BKGBW  
 Date of Bkg. Cal: 2/7/04  
 Alpha efficiency logfile: Am-221-11/03  
 Alpha attenuation calibration: ABA1103.XLS  
 Beta efficiency logfile: Sr85-11/03  
 Beta attenuation calibration: ABA1103.XLS

Alpha Attenuation Calibration			Beta Attenuation Calibration		
y = b*m^-x (mass=x0)			y = b*m^-x (mass=x0)		
Alpha b=	1.24550		Beta b=	1.0000	
m=	0.99400		m=	0.9999	
a=	1.0000		a=	1.0000	
x0=	0.0000		x0=	0.0000	

Alpha Activity										Beta Activity													
Det.	Sample ID	Count End	Count Date & Time	Resid. Dur.	Resid. Mass (mg)	Gross CPM		Bkg. CPM		B>a x talk		Base CPM		Bkg. CPM		a>b x talk		Base CPM		Progeny Eff		Progeny Cor.Fact.	
						Eff	Cor.Fact.	Eff	Cor.Fact.	Eff	Cor.Fact.	Eff	Cor.Fact.	Eff	Cor.Fact.	Eff	Cor.Fact.	Eff	Cor.Fact.	Eff	Cor.Fact.		
D4	0414019-S4-A	2/11/04 11:08	30.00	0.0	0.067	0.126	0.001	0.2090	1.246	n/a	n/a	1.761	1.604	0.0183	0.4620	1.000	1.000	n/a	n/a	n/a	n/a		
D1	0414019-S1-A	2/11/04 11:08	30.00	0.0	4.100	0.142	0.211	1.518	1.246	n/a	n/a	2169.067	1.540	1.1234	0.4595	1.000	1.000	n/a	n/a	n/a	n/a		
D2	0414019-S2	2/11/04 11:08	30.00	0.0	3.400	0.148	1.516	0.2101	1.246	n/a	n/a	2165.500	2.067	0.4611	0.9316	1.000	1.000	n/a	n/a	n/a	n/a		
D3	0414019-S3	2/11/04 11:08	30.00	0.0	3.667	0.097	1.520	0.2103	1.246	n/a	n/a	2171.500	1.706	0.0047	0.4753	1.000	1.000	n/a	n/a	n/a	n/a		

52/1/04

000105

RG  
2/11/04

PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B  
 Counting Unit ID: Aqua  
 High Voltage Mode: Simultaneous  
 Application Revision: 2  
 Application Version: Standard  
 Rev.12/29/03 JE

Data file name: SR0210  
 Batch ID: SR09 VENIF  
 Count Preset (m): 60  
 Batch Enddate: 2/10/04 13:00  
 Background logfile: BK0ABW  
 Date of Bkg. Cal: 2/7/04  
 Alpha efficiency logfile: Ama241-11/03  
 Alpha attenuation calibration: AB41103.XLS  
 Beta efficiency logfile: SR09-11/03  
 Beta attenuation calibration: AB41103.XLS

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = b'm^x/a \text{ (mass>0)}$		$y = b'm^x/a \text{ (mass>0)}$	
Alpha b=	1.24550	Beta b=	1.0000
m=	0.99400	m=	0.9999
a=	1.0000	a=	1.0000
x0=	0.0000	x0=	0.0000
Alpha to Beta X-talk		Beta to Alpha X-talk	
$y = m^x \text{ mass}$		$y = m^x \text{ mass}$	
$a \rightarrow b \text{ Xtalk } m=$	0.2740	$b \rightarrow a \text{ Xtalk } m=$	-2.00E-06
$x \rightarrow b \text{ Xtalk } b=$	1.0010	$b \rightarrow a \text{ Xtalk } b=$	0.0007

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity				Beta Activity						
					Gross CPM	Bkg. CPM	b>a Xtalk CPM	Base Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b Xtalk CPM	Base Eff	Progeny Cor.Fact.	Progeny Cor.Fact.
C1	0414016-S1	2/10/04 13:00	60.00	0.0	0.533	0.109	0.153	0.2170	n/a	218450	1.511	0.1461	1.000	n/a	n/a
C2	0414016-S2	2/10/04 13:00	60.00	0.0	0.483	0.124	0.149	0.2127	n/a	213400	1.497	0.1324	1.000	n/a	n/a
C3	0414016-S3	2/10/04 13:00	60.00	0.0	0.867	0.138	0.153	0.2117	n/a	218750	1.655	0.2375	0.4696	1.000	n/a
C4	0414016-S1	2/10/04 13:00	60.00	0.0	0.217	0.119	0.001	0.2063	1.246	1.550	1.570	0.0594	0.4654	1.000	n/a

000106

RG 2/11/04

# Paragon Analytics, Inc.

pg 273536 a  
(cont. from pg 273536 b)

## Low Background Gas Flow Proportional Counter Log

### Instrument: LB4100B

Date: 2/10/04

#### Instrument Background and Response Checklist

P-10 Supply	P-10 Flow
1 <u>OK</u>	A <u>OK</u> , i
2 <u>OK</u>	B <u>OK</u>
C <u>OK</u>	
D <u>OK</u>	

Bkg File ID

Dr A OK, OK

Dr B OK

Dr C OK

Dr D OK

#### Instrument Background and Response Checklist

Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	On-line	Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	On-line
1 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
2 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
3 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
4 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
5 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
6 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
7 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
8 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
9 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
10 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
11 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>
12 <u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>		<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>	<u>OK</u>

P = passes; R = Recount; H = high; L = low;  $\alpha$  = Alpha; B = Beta; DR = Daily Response Check; Stat = Status; Det = Detector; Bkg = Background; OL = Offline; NP = Not Processed.

#### Runlog

Det	Sample ID	Batch	Test	File ID	Crt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Outp. Batch
1-6	DR Checks	-	-	EFB0210	30	06:15	LCB	LCB	2/10/04	S-A
1-6	Bkg Checks	-	-	BKB0210	30-360	06:29	LCB	LCB	2/10/04	S-A
1-12	Bkg Recount	-	-	BKB0210A	60	07:32	LCB	LCB	2/10/04	S-A
1-4	Offline-Signals	14000 TRA.xls	Calibration	ERB210A	30	08:45	S	S	2/10/04	
5-8				ERB210B	1	08:53	S	S		
9-10				ERB210C	1	08:58	L	L		
11-12				ERB210D	1	09:02	L	L		
1	040221-1	AB040205-4	#9	AB0210	120	09:22	OP	OP		Spacet
2	04020205-15		/		6		L	L		
3	04020205-415		/		6		L	L		
7	0402088-1	AB040205-3	#12	AB0210A	120	09:23	OP	OP		
8			/		6		L	L		
9			/		6		L	L		
10			/		6		L	L		
11			/		6		L	L		
12	0401089-1		/		6		L	L		

Comments:  
Form 780-6.frm (4/6/2001)

Reviewed by: LAR Date: 2/11/04

Date: 21/10/04

Det	SnipID	Batch	Test	File ID	Cut Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Count Below
13	040108P-2	AB040205-3	218	AB00210A	120	0923	9	8	21/10/04	21A
14		-3	L							
15		-4	L							
16		-5	L							
17	041016-S1	259555a	SC89	SC00210	6030	1153	9	5	21/10/04	
18		-52	L							
19		-53	L							
20	0414014-B1	AB040205-3	210	AB00210B	120	1157	9	8	21/10/04	
21	0401089-C	AB040205-3	211							
22		-7	L							
23	AB090205-3NB									
24		-3LCS	L							
25		-3LCS	L							
26		-51	L							
27	0419002-S1	140025Kw.NES	SC90	SC00210A	60	1202	9			
28		-52	L							
29		-53	L							
30		-54	L							
31	040220-1	AB040205-1	213	AB00210C	1000	1415	8	60	21/11/04	
32		-2	L							
33	04022019-7									
34		-1D	L							
35		-2	L							
36	0402020-1									
37		-3	L							
38	AB040205-1NB									
39	0401029-14	AB040203-1	213	AB00210D	1000	1417	7			
40		-15	L							
41		-16	L							
42	AB010203-1NB									
43		-17	L							
44		-18	L							
45	AB010203-1NB									

Form 780r6.frm (4/6/2001)

Comments:

000108

Reviewed LWDate 21/11/04Date 21/11/04

(cont. from pg N/A) a)

**Low Background Gas Flow Proportional Counter Log**  
**Instrument: LB4100B**

Date: 2/11/04

**Instrument Background and Response Checklist**

Det	SmplID	Batch	Test	File ID	Cnt Dyr. (minutes)
1-16	DR Checks	-	-	EFD0211	30
4-5-6	DR Recount	-	-	EFB0211A	30
1-16	Drg Checks	-	-	BKB0211	60
1-4	241400-S12345	1400UTRA.XLS	Razzia!	ETRB211A	30
5-8				ETRB211B	2434
9-13				ETRB211C	0941
1	041232-1	AB 040204-2	X13	ETRB211D	0938
2				AB00211	1034
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Det	SmplID	Batch	Test	File ID	Cnt Dyr. (minutes)
1-16	DR Checks	-	-	EFD0211	30
4-5-6	DR Recount	-	-	EFB0211A	30
1-16	Drg Checks	-	-	BKB0211	60
1-4	241400-S12345	1400UTRA.XLS	Razzia!	ETRB211A	30
5-8				ETRB211B	2434
9-13				ETRB211C	0941
1	041232-1	AB 040204-2	X13	ETRB211D	0938
2				AB00211	1034
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

P = passes; R = Recount; H = high; L = low;  $\alpha$  = weekly; W = weekly;  $\alpha$  = Alpha; B = Beta; DR = Daily Response Check; Stat = Status; Det = Detector; Bkg = Background; OL = Offline; NP = Not Processed.

Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	On-line
P-10 Flow Supply																	
1650	A $\alpha$ , i	1	Pass	Pass													
21020	B	2	Pass	Pass													
Bkg	C	3	Pass	Pass													
Cat. File ID	D	4	Pass	Pass													
Dr A	Dr B	5	Pass	Pass													
Dr C	Dr D	6	Pass	Pass													
		7	Pass	Pass													
		8	Pass	Pass													

Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	On-line
1-16	DR Checks	-	-	-	EFD0211	-	-	-	LCB	LCB	LCB	-	LCB	LCB	LCB	LCB	LCB
4-5-6	DR Recount	-	-	-	EFB0211A	30	0806	LCB	LCB	LCB	LCB	2/11/04	LCB	LCB	LCB	LCB	LCB
1-16	Drg Checks	-	-	-	BKB0211	60	0816	LCB	LCB	LCB	LCB	2/11/04	LCB	LCB	LCB	LCB	LCB
1-4	241400-S12345	1400UTRA.XLS	Razzia!	ETRB211A	ETRB211A	30	0922	S	S	S	S	2/11/04	ETRB211B	ETRB211B	ETRB211B	ETRB211B	ETRB211B
5-8				ETRB211B	ETRB211B	2434											
9-13				ETRB211C	ETRB211C	0941											
1	041232-1	AB 040204-2	X13	ETRB211D	ETRB211D	0938											
2				AB00211	AB00211	1034											
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	

Date: 2/11/04

Reviewed by

Form 780v6, fm (4/6/2001)

Comments:

Date: 2/11/04

Low Background Gas Flow Proportional Counter Log  
Instrument: LB4100B

Det	SampID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Count Below
12	0414019-51	2595589	5589	SRB0211	30	1038	8	8	2/11/04	✓
14	L	-52	L	L	L	L	L	L	2/11/04	
15	L	-53	L	L	L	L	L	L	2/11/04	
16	L	-51	L	L	L	L	L	L	2/11/04	
1	0401232-9	40040304-0	013	AB00211A	60	1140	8	8	2/11/04	
2	L	-918	L	L	L	L	L	L	2/11/04	
4	L	-10	L	L	L	L	L	L	2/11/04	
7	L	-11	L	L	L	L	L	L	2/11/04	
8	L	-12	L	L	L	L	L	L	2/11/04	
9	L	-13	L	L	L	L	L	L	2/11/04	
10	46090209-2109	L	L	L	L	L	L	L	2/11/04	
11	L	-315	L	L	L	L	L	L	2/11/04	
12	0403017-1	40040205-2	013	AB00211B	10	1147	8	8	2/11/04	
13	L	-2	L	L	L	L	L	L	2/11/04	
14	AB040205-2103	L	L	L	L	L	L	L	2/11/04	
15	0403017-1D	AB040205-2	013	AB00211C	10	1215	8	8	2/11/04	
16	A0040205-2105	L	L	L	L	L	L	L	2/11/04	
1	0401211-2	40040206-1	01228	AB00211	250	1327	8	8	2/11/04	
2	0402019-1	L	L	L	L	L	L	L	2/11/04	
4	L	-2	L	L	L	L	L	L	2/11/04	
7	0402023-11	L	L	L	L	L	L	L	2/11/04	
6	L	-110	L	L	L	L	L	L	2/11/04	
9	L	-12	L	L	L	L	L	L	2/11/04	
10	L	-13	L	L	L	L	L	L	2/11/04	
11	L	-14	L	L	L	L	L	L	2/11/04	
12	L	-15	L	L	L	L	L	L	2/11/04	
13	24040226-1103	L	L	L	L	L	L	L	2/11/04	
14	L	-165	L	L	L	L	L	L	2/11/04	

Form 780r6.frm (4/6/2001)

Comments:

000110

Reviewed \_\_\_\_\_

Date 2/11/04

A

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES

Electronic Benchsheet No. (if / when generated) A Reviewed by / Date MT 2/1/04 Page 1 of 2 Form 798r0.frm (5/12/2002)

259555

B

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES / ACTINIDES

Paragon Analytics, Inc.

Initials <u>LJ</u>	Date <u>5/11/04</u>	Method (SOP / Rev) <u>NA</u>	Matrix <u>UHT</u>
COMMENTS			
<p><u>Sr</u> STANDARD VERIFICATION</p> <ul style="list-style-type: none"> <li>- Spike &amp; carrier added directly to plowelt</li> <li>- 10% HNO<sub>3</sub> added (~5ml) to convert HCl</li> <li>- Plowelt dried on hotplate</li> </ul>			

Reviewed by / Date

KST 2/10/04

000112

Page 2 of 2

Form 798r0.frm (5/12/2002)



## B WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES / ACTINIDES

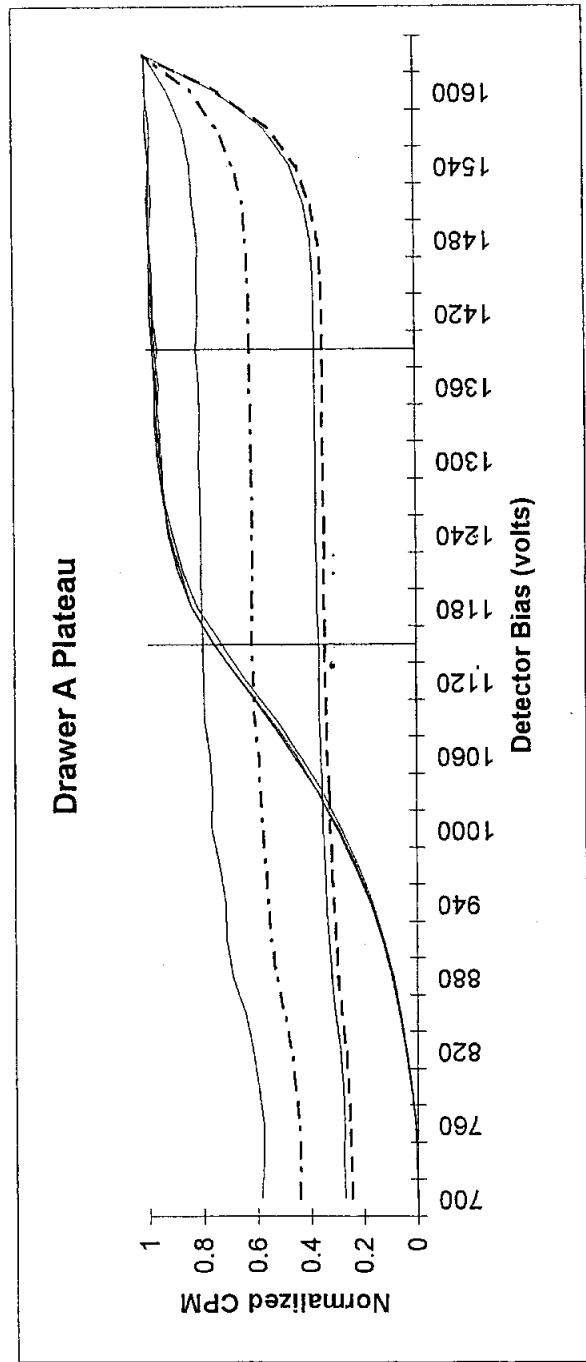
Initials <u>CJ</u>	Date <u>02/11/04</u>	Method (SOP / Rev) <u>LAA</u>	Matrix <u>UATR</u>
COMMENTS			
<p><u>BY SP</u> S/S VERIFICATION</p> <ul style="list-style-type: none"> <li>- IN 5mL 16K400<sub>3</sub> ADDED TO PLATE HET</li> <li>- SPIKE &amp; CLEP LIP ADDED TO PLATE HET</li> <li>- PLATES DENIED ON HOT PLATE</li> </ul>			

Reviewed by / Date JULIA 02/11/04

000114

Unit Type: LB4100/W  
Date Performed: 11/11/03 09:19  
FileName: PTB111A  
Batch ID: DRAWER A

Unit Id: Aqua  
Application Revision: 2  
Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

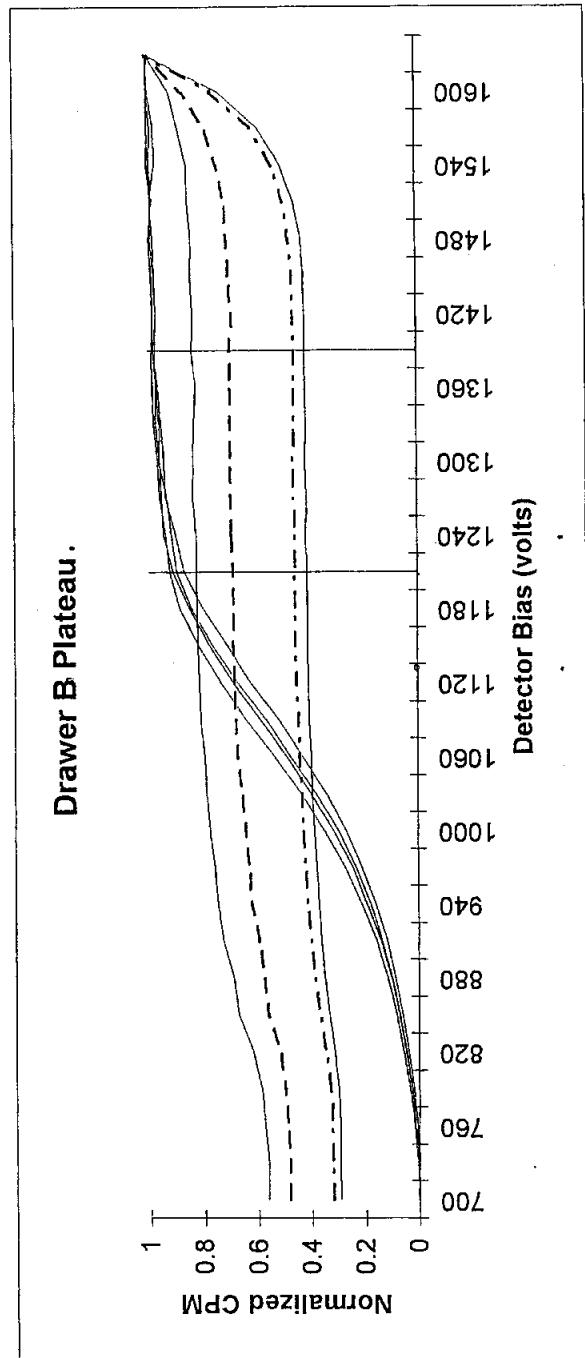
Optimum alpha only operating voltage:

	A1	A2	A3	A4
Beta slope at beta voltage	1.73%	1.36%	2.04%	1.59%
Alpha slope at beta voltage	0.75%	0.45%	0.63%	0.66%
Alpha slope at alpha voltage	1.76%	1.86%	1.20%	0.79%

JL  
11/13/03

Unit Type: LB4100/W  
Date Performed: 11/11/03 09:19  
FileName: PTB111B  
Batch ID: DRAWER B

Unit Id: Aqua  
Application Revision: 2  
Application Version: Standard



Optimum alpha beta simultaneous operating voltage: 1402.5

Optimum alpha only operating voltage: 1200

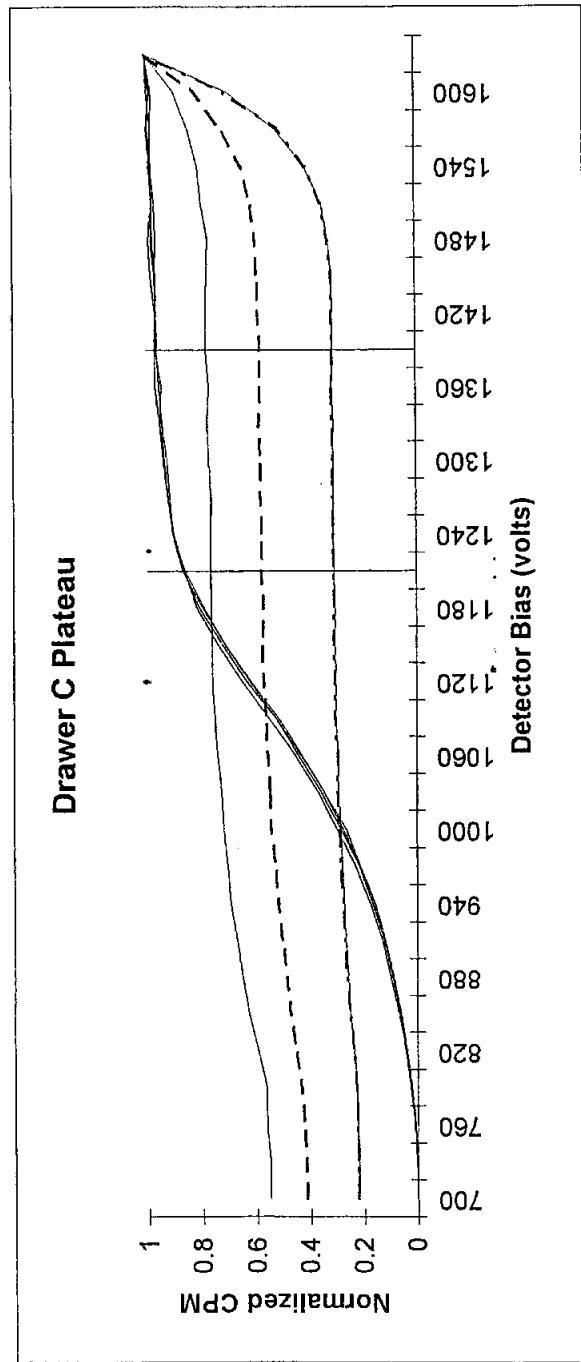
	B1	B2	B3	B4
Beta slope at beta voltage	0.25%	1.73%	1.96%	1.01%
Alpha slope at beta voltage	1.26%	0.14%	0.86%	0.88%
Alpha slope at alpha voltage	1.42%	0.92%	0.63%	0.59%

JK  
11/13/03

000116

Unit Type: LB4100/W  
Date Performed: 11/11/03 15:41  
FileName: PTB111C  
Batch ID: DRAWER C

Unit Id: Aqua  
Application Revision: 2  
Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

Optimum alpha only operating voltage:

	C1	C2	C3	C4
Beta slope at beta voltage	1.97%	2.08%	1.59%	2.05%
Alpha slope at beta voltage	0.49%	0.66%	0.69%	-0.24%
Alpha slope at alpha voltage	0.44%	1.15%	1.08%	1.14%

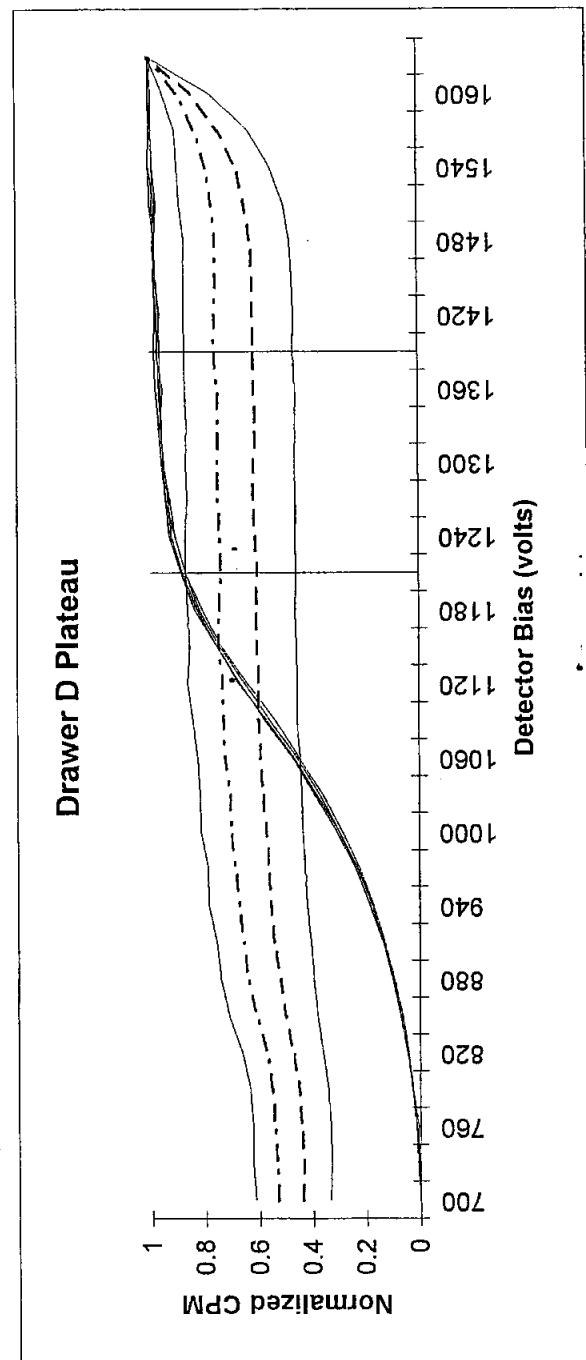
11/13/03

Printed 11/12/03 11:16 AM

000117

Unit Type: LB4100W  
Date Performed: 11/11/03 15:42  
FileName: PTB1111D  
Batch ID: DRAWER D

Unit Id: Aqua  
Application Revision: 2  
Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

Optimum alpha only operating voltage:

	D1	D2	D3	D4
Beta slope at beta voltage	1.81%	2.16%	1.11%	1.43%
Alpha slope at beta voltage	1.57%	0.87%	0.73%	0.96%
Alpha slope at alpha voltage	0.20%	1.53%	0.77%	0.04%

CE  
11/13/03

Printed 11/12/03 11:17 AM

000118

PROJECT LB4100-B

Continued From Page

10/8/03 Complete computer back-up was performed  
 JE File name: LB4100 B10/8/03  
 Scan disk was done and the computer was defragged.

PF 10/23/03  
 CW 10/20/03

11/1/03 LB4100-B Calibrations

JE 11/1/03

Plates

Source Used

Dct

Sr/Y -90 - 406

A1 A3 C1 C3

36,500 dpm - 407

A2 A4 C2 C4

Tc 9/19/92 - 408

B1 B3 D1 D3

↓ - 409

B2 B4 D2 D4

Am-241 - 410

A1 A3 C1 C3

17,800 dpm - 411

A2 A4 C2 C4

Tc 2/6/95 - 412

B1 B3 D1 D3

↓ - 413

B2 B4 D2 D4

Parameters:

Start Voltage: 700

File names:

PTB1111A

End Voltage: 1650

PTB1111B

30 volts / step

PTB1111C

5 min / step

PTB1111D

40,000 count preset

11/12/03 ROI's are set using the same Sr/Y-90 sources that were used in the plateaus.

11/14/03 Initial weekly BKG is performed.

JE

11/14/03

Continued on Page

Read and Understood By

Renell Allegro  
Signature

11/13/03

Julie Ellinger  
Signature

11/13/03

Date 000119

LB4100-B Raw counts for Sr-89 On Flat Planchet Efficiency Calibrations (Control ID #1131)						
Detector ID	A1	A2	A3	A4	B1	B2
total time	25.85	26.52	25.96	25.49	26	25.97
total counts	10004	10004	10000	10004	10004	10005
Beta CPM	385.696934	375.80074	383.76901	391.055634	383.10023	383.60119
Beta BKG CPM	1.305	1.424	1.439	1.412	1.669	1.497
Beta Efficiency	0.4203683	0.4095825	0.4182671	0.42620871	0.4176502	0.4181963
archived STDEV	0.02184833	0.0212884	0.0217399	0.02215226	0.0217086	0.0217364
Data file	ES89218A	ES89218A	ES89218A	ES89218A	ES89218B	ES89218B
Detector ID	C1	C2	C3	C4	D1	D2
total time	25.22	25.98	25.14	25.87	26.16	25.39
total counts	10004	10002	10003	10001	10000	10002
Beta CPM	395.16731	383.41445	396.27081	385.00878	380.75	391.92762
Beta BKG CPM	1.502	1.574	1.621	1.578	1.513	2.007
Beta Efficiency	0.43091331	0.4180973	0.4321166	0.41983586	0.4153033	0.4274953
archived STDEV	0.0223971	0.0217316	0.0224602	0.02182195	0.0215862	0.0222217
Data file	ES89218C	ES89218C	ES89218C	ES89218C	ES89218D	ES89218D
Detector ID	C1	C2	C3	C4	D1	D2
total time	25.22	25.98	25.14	25.87	26.16	25.39
total counts	10004	10002	10003	10001	10000	10002
Beta CPM	395.16731	383.41445	396.27081	385.00878	380.75	391.92762
Beta BKG CPM	1.502	1.574	1.621	1.578	1.513	2.007
Beta Efficiency	0.43091331	0.4180973	0.4321166	0.41983586	0.4153033	0.4274953
archived STDEV	0.0223971	0.0217316	0.0224602	0.02182195	0.0215862	0.0222217
Data file	ES89218C	ES89218C	ES89218C	ES89218C	ES89218D	ES89218D

OKS  
3/8/04

*Source Database for OSUM for LB4100-B*

Number of sources in table: 50

Application Revision: A

Control ID	Isotope	Type	Half-Life (days)	DPM	Std dev	Date	Status	Alpha/Beta Archive File
1125	Th-230	Alpha	27539850	1980.14	99.01	2-Jul-02	PA	Th230-1/04
1126	Pb-210	Beta	8145.075	1187.602	59.38	18-Jun-03	PA	Pb210 -1/04
1129	Ra-226	Alpha	584400	4207.96	210.40	9-Sep-91	PA	Ra226-02/04
1130	Pb-210	Beta	8145.075	5938.01	296.90	18-Jun-03	PA	Pb210 -2/04
1131	Sr-89	Beta	50.53	2256.7	112.84	15-Dec-03	PA	Sr89-2/04

2/18/04 Sr89 Calibration - Sr89 on Flat planchets

Benchsheet: 259560a Source ID: 1131 Log file: Sr89-02/04  
Panchets: 0414022-S1-S5

Sources:

0414022-S1

|  
-S2  
-S4  
-S5

Det:

A1 B1 C1 01

A2 B2 C2 02

A3 B3 C3 03

A4 B4 C4 04

Filenames:

ES89218A

ES89218B

ES89218C

ES89218D

2/18/04 Full computer backup is performed.

Filename: 2/18/04 LB4100.B 3/2/04

2/19/04 # Quarterly Plateau Verification performed

2/24/04 Filenames: PTB0219A PTB0224C  
PTB0219B PTB0224D

All voltage settings verify. 3/2/04

2/23/04 Pb210 Calibration - Pb-210 on Flat Planchets (w/ foil)

Benchsheet: 14009 Pb.xls Source ID: 1130

Sources: 0414009-S1

|  
-S2  
-S3  
-S5

Det: A1 B1 C1 01

A2 B2 C2 02

A3 B3 C3 03

A4 B4 C4 04

Filenames: EPB0223A

EPB0223B

EPB0223C

EPB0223D

PB210  
Cw

3/2/04

Continued on Page

Read and Understood By

Alan Lenia

Signed

3/2/04

Date



Signed

3-2-04

000122

pg 273547 a  
(cont. from pg 111 b)

## Paragon Analytics, Inc.

SOP 724 Rev 3

Date: 2/18/04

### Low Background Gas Flow Proportional Counter Log

Instrument: **LB4100B**

#### *Instrument Background and Response Checklist*

P-10 Supply		P-10 Flow		DR		DR		Cmnt		Bkg		Cmnt		On-line	
Det	DR	1	2	DR	Stat	Cmnt	Bkg	1	2	Bkg	Stat	Cmnt	DR	DR	On-line
1 (α)	Lαβ	P		Lαβ		P	P			✓	9	Lαβ	P	P	✓
2 (βγ)	B	2								✓	10				✓
C		3								✓	11				✓
D	↓									✓	12				✓
Bkg.															
Dr A	B <sub>1</sub> β <sub>2</sub> γ <sub>3</sub> 13W	5	Lβ	P						✓	13				✓
Dr B		6	P							✓	14				✓
Dr C		7	↓	↓						✓	15				✓
Dr D		8	↓	↓						✓	16				✓

P = passes; R = Recount; H = high; L = low; α = weekly; β = monthly; γ = daily; W = weekly; DR = Daily Response Check; Stat = Status; Det = Detector; Bkg = Background; OL = Offline; NP = Not Processed.

#### *Runlog*

Det	Sample ID	Batch	Test	File ID	Cut Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Cmnt Below
1-16	DR Checks	-	-	EFB0218	30	0615	Lαβ	Lαβ	2/18/04	NA
1-16	Bkg Checks	-	-	BK0218	60	0632	Lαβ	Lαβ	2/18/04	
4	Drug Releasat	A N/A	-	BK0218A	60	0746	Lαγ	Q	2/18/04	
1	0462036-2	AB040213-1	2/13	AB0218	100	0746	Lαβ	Q	2/18/04	
2	-3									
3	-4									
7	-5									
8	-6									
9	-8									
10	-9									
11	-10									
12	-12									
13	-13									
14	-14									
15	-15									
16	-16									

Form 780r6.frm (4/6/2001)  
Comments:

Reviewed by \_\_\_\_\_

Date: 2/18/04

pg 273348 a)  
 (cont. from pg 273547) b)

## Paragon Analytics, Inc.

### Low Background Gas Flow Proportional Counter Log

#### Instrument: LB4100B

SOP 724 Rev 8

Date: 2/18/04

#### Instrument Background and Response Checklist

P-10 Supply		P-10 Flow		Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	On-line	Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Bkg Stat	Cmnt	On-line
1	*	A	*	1	*	2								9	*								
2	✓	B		2										10									
		C		3										11									
		D	✓	4										12									
<i>Bkg.</i>		<i>Cal. File ID</i>		5										13									
Dr A		*		6										14									
Dr B		†		7										15									
Dr C		†		8										16									
Dr D		✓																					

P = passes; R = Recount; H = high; L = low; W = weekly; α = Alpha; B = Beta; DR = Daily Response Check; Stat = Status; Det = Detector; Bkg = Background; OL = Offline; NP = Not Processed.

\* daily check & clean - info is found on page 273547a. J 2/18/04

#### Runlog

Det	SampleID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Cmnt Below
1-4	2414022151521455	259540	SR89Car115	ES89218A	60	1410	CF	J	2/18/04	PA
8	AB0402344	AB0218213-2	αB	AB0218D	10	1414	CF	Q	2/18/04	
9	0402073-1	AB020213-5	αB	AB0218E	10	1417	CF	L	2/18/04	
10	AB040213-5H8	L	L	AB0218F	10	1434	CF	Q	2/18/04	
10	0402073-1D	AB040213-5	αB	AB0218G	10	1434	CF	Q	2/18/04	
11	AB040213-5H9J	L	L	AB0218H	10	1437	CF	Q	2/18/04	
12	-5B2CS	L	L	ES89218B	60	1437	CF	Q	2/18/04	
5-8	041402215255	259560	SR89Car115	ES89218C	60	1504	L	L	2/18/04	
9-12	AB040213-34LG	AB0213-3	αB	ES89218D	10	1531	L	L	2/18/04	
13-16	AB0402036-35D	AB040213-3	αB	AB0218G	10	1450	CF	Q	2/18/04	
1	AB0402036-35D	AB040213-3	αB	AB0218H	100	1539	CF	Q	2/18/04	
2	AB0402036-35D	AB040213-3	αB	AB0218I	100	1539	CF	Q	2/18/04	

Since  $D \parallel D' - A$   
 $|B| - B$

Paragon Analytics, Inc.

653560

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES

Page 1 of 1 Form 780.11M (JULY 2002)

25956 B

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES / ACTINIDES

Initials <u>AB</u>	Date <u>02/13/04</u>	Method (SOP / Rev) <u>k4t</u>	Matrix <u>water</u>
COMMENTS			
<p><u>210 Pb</u> <del>Bt</del> <del>esc</del> <del>8</del> <u>02/13/04</u></p> <p><u>89Sr</u> Efficient Pouchets</p> <ul style="list-style-type: none"> <li>- Pouchets spiced &amp; carrier added to 5 mL 16N HNO<sub>3</sub> ON POUCHET.</li> <li>- Dried on HOT PLATE</li> </ul>			

NT 21701

000126

PREPARE A WORKING LEVEL SPiking SOLUTION (APPROX 1000 dpm/ml) OF <sup>89</sup>Sr STANDARD BY DILUTING STANDARD 735.2613.35 WITH 0.1M HCl. HCl LOT #: 43268

### 1. DETERMINE THE DENSITY OF 0.1M HCl

$$\text{MASS OF EMPTY CLASS A VOLUMETRIC FLASK} = 68.2952 \text{ g} \quad \text{Bal} \# 1$$

$$\text{MASS OF FLASK + 100 ml 0.1M HCl} = 168.0944 \text{ g} \quad \text{Bal} \# 12$$

$$\text{NET MASS OF 0.1M HCl} = 99.7992 \text{ g}$$

$$\rho = 0.9980 \text{ g/ml}$$

### 2. TRANSFER STANDARD 735.2613.35 TO A 40ml VIAL

$$\text{MASS OF 40 ml VCA VIAL w/o LD} = 21.2212 \text{ g} \quad \text{Bal} \# 12$$

$$\text{MASS OF VIAL + STANDARD} = 21.6216 \text{ g}$$

$$\text{NET MASS OF STANDARD} = 0.4004 \text{ g}$$

### 3. ADD 0.1M HCl TO FINAL DILUTION

$$\text{MASS OF 40 ml VCA VIAL w/o LD} = 21.2212 \text{ g} \quad \text{Bal} \# 12$$

$$\text{MASS OF VIAL + STANDARD + 0.1M HCl} = 61.6746 \text{ g}$$

$$\text{NET MASS OF STD + 0.1M HCl} = 40.4534 \text{ g}$$

### 4. FINAL ACTIVITY CALCULATION

$$(114.729.104 \text{ dpm/g}) \times 0.4004 \text{ g} \times (0.9980 \text{ g/ml}) = 1128.35 \text{ dpm/ml}$$

40.4534 g

REF DATE: 12/15/03 (12:00 EST)

Stnd ID: 735.2613.36

RF 2/19/04

Description: Sr-89  
 Expiration: 2/11/05  
 Activity: 1128.35 dpm/mL

RF 2/19/04

2s Uncertainty: 25.95 dpm/mL  
 Ref. Date: 12/15/03  
 Ref Time: N/A  
 Prep Date: 2/11/04 Prep by: AF  
 Matrix/Comp. 0.1 M HCl  
 Half Life (y): 1.38E-01

Continued on Page \_\_\_\_\_

Read and Understood By

Signed

02/09/04  
Date

Bennet Hollings  
Signed

2/19/04  
Date 000127

PROJECT

735.2613.35 - Sr-89

Notebook No. 2613

35

Continued From Page

TRANSFER 50.1676g OF  $^{89}\text{Sr}$  STANDARD IN 0.1M HCl  
 TO 2 VOA VIALS. ( $^{89}\text{Sr} = 30\text{ g/g}$ ) PAID H 735  
 SRS: 67308A-307 80218/04

VOA VIAL #1 TARE = 26.0978g  
 ↓ FINAL = 62.5504g  
36.4526g

Bal #12  
 ↓

VOA VIAL #2 TARE = 26.0640g  
 ↓ FINAL = 39.5676g  
13.5036g

Bal #12  
 ↓

### ACTIVITY CALCULATION

$$\frac{(9.55184)(60 \text{ sec/min})}{(50.1676g)} = 114,229.104 \text{ dpm/g}$$

REF DATE: 12/15/03, 12:00 EST

Label Added After  
 "Z" out. RG 2/19/04

Stnd ID: 735.2613.35 RG 2/19/04

Description: Sr-89

Expiration: 2/11/05

Activity: 114229.10 dpm/mL

2s Uncertainty: 2627.27 dpm/mL

Ref. Date: 12/15/03

Ref Time: N/A RG 2/19/04

Prep Date: 2/11/04 Prep by: AF

Matrix/Comp. 0.1 M HCl

Half Life (y): 1.38E-01 RG 2/19/04

RG 2/19/04

Continued on Page

Read and Understood By

Signed

02/09/04

Date

Signed

2/19/04

Date 000128

**CERTIFICATE OF CALIBRATION**

Standard Radionuclide Source

67308A-307

PAT ID 0735  
Recd 12-30-03

Sr-89 50 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Sr-89
ACTIVITY (dps):	9.551 E4
HALF-LIFE:	50.53 days
CALIBRATION DATE:	December 15, 2003 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	2.3%

Impurities:  $\gamma$ -impurities <0.1%50.1676 grams 0.1M HCl solution with 30  $\mu$ g/g Sr carrier.

P O NUMBER EW120103, Item 1

SOURCE PREPARED BY: M. Taskaeva  
M. Taskaeva, RadiochemistQ A APPROVED: J.M. Mitz 12-18-03

000129

### New Standard Verification

WO# 0414016,0414019  
 Date 2/1/04  
 Date 2/10/04

WC-0414019	STD 735.2613.35	WO-0414016	STD 735.2613.36
Nuclide Sr-89	Nuclide Sr-89		
Half Life 50.53 days	Half Life 50.53 days		
Init Activity 114229.1 dpm/mL	Init Activity 1128.35 dpm/mL		
Ref. Date 12/15/03	Ref. Date 12/15/03		
Vol. 0.100 mL	Vol. 1.0 mL		
Current Spiked Act. 5155.19 dpm	Current Spiked Act. 516.26 dpm		

Background	CPM	
Sample ID	0414016-B1	1.650
	0414019-B2	1.767

1.71 Ave. (Background used)

Standards	GCM	BCPM	NCPM	% Yield	DPM Added	Eff.	Ave. Eff.	Calibrated			(PAI Req.)	(ICPT Req.)
								Efficiency	Calc DPM	Avg DPM	2 StdDev	
0414019-S1	2169.07	1.71	2167.38	100%	5155.19	0.4204	0.4203					
0414019-S2	2165.50	1.71	2163.79	100%	5155.19	0.4197	0.4203					
0414019-S3	2171.50	1.71	2169.79	100%	5155.19	0.4209	0.4203					
0414016-S1	218.45	1.71	216.74	100%	516.26	0.4198	0.4203					
0414016-S2	213.40	1.71	211.69	100%	516.26	0.4190	0.4203					
0414016-S3	218.75	1.71	217.04	100%	516.26	0.4204	0.4168					

r:\inst\gpm\14019sv.xls

DUC 2/11/04  
 RC 2/11/04

*Paragon Analytics, Inc.*

**QUALITY ASSURANCE SUMMARY SHEET**

**263234**

PAI W.O. # / BATCH Sr-89 Verification

TEST Sr-89

METHOD ICP-MS

SOP/REV (PREP) -

SOP/REV (ANAL) 734R8

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

In the absence of a second source for Sr-89, standard 735.2613.35 (parent) is verified against 735.2613.36, a dilution of 735.2613.35. Standard 735.2613.35 is NIST traceable and was prepared by direct from vendor. Transferring Std ID 735 to VOT vials. 735.2613.36 was diluted and prepared as stated in standards logbook. X

RG  
2/12/04

TECHNICIAN/ANALYST

Paul Yemicin

DATE 2/11/04

DEPARTMENT MANAGER

Bonnie Hollings

DATE 2/12/04

# PAI - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B  
 Counting Unit ID: Aqua  
 High Voltage Mode: Simultaneous  
 Application Revision: Standard  
 Rev:12/29/03 JE

Data file name: SR8P211  
 Batch ID: SR8P VERIFY  
 C-Count Preset (m): 30  
 Batch Ended: 2/11/04 11:08

Date of Bkg. Cal: 2/7/04  
 Alpha efficiency logfile: Am224-11/03  
 Alpha attenuation calibration: ABA1103.XLS  
 Beta efficiency logfile: SR8g-11/03  
 Beta attenuation calibration: ABA1103.XLS

Alpha prog. logfile: n/a  
 Alpha prog. attenuation: n/a  
 Beta prog. logfile: n/a  
 Beta prog. attenuation: n/a

Det. ID	Sample ID	Count End Date & Time	Resid. Dur. (min)	Alpha Activity				Gross CPM	Bkg. CPM	Progeny CPM	Gross CPM	Bkg. CPM	Progeny CPM	Base Eff	Cor.Fact.	Base Eff	Cor.Fact.	Base Eff	Cor.Fact.	Progeny Eff	Cor.Fact.	Progeny Cor.Fact.	
				Count	Base CPM	Bkg. CPM	b>a XTLK CPM																
D4	044019-S4	2/11/04 11:08	30.00	0.0	0.067	0.126	0.001	0.2090	1.246	n/a	1.767	1.604	0.0183	0.4620	1.000	1.1234	0.4595	1.000	1.000	n/a	n/a	n/a	
D1	044019-S1	2/11/04 11:08	30.00	0.0	4.100	0.142	1.518	0.2111	1.246	n/a	2169.067	1.540	0.9316	2.087	0.4611	1.000	2165.500	1.0047	0.4753	1.000	n/a	n/a	n/a
D2	044019-S2	2/11/04 11:08	30.00	0.0	3.400	0.148	1.516	0.2101	1.246	n/a	2171.500	1.766	1.000	1.246	0.2103	0.097	1.520	0.097	1.520	0.097	n/a	n/a	n/a
D3	044019-S3	2/11/04 11:08	30.00	0.0	3.667	0.097	1.520	0.2103	1.246	n/a	2171.500	1.766	1.000	1.246	0.2103	0.097	1.520	0.097	1.520	0.097	n/a	n/a	n/a

5/2/11/04

$y = b \cdot m^x + c$ (mass=0)	Alpha b= 1.24550	Alpha m= 0.96100	Alpha x0= 1.0000	Alpha beta= 0.9999
		a= 1.0000	x0= 1.0000	
			x0= 1.0000	
$y = b \cdot m^x + c$ (mass=0)	Alpha to Beta X-Talk	Alpha to Beta X-Talk	Alpha to Beta X-Talk	Alpha to Beta X-Talk
$y = m^x + b$	$b \rightarrow a$ X-Talk m= -2.01E-06	$b \rightarrow a$ X-Talk m= 0.0007	$b \rightarrow a$ X-Talk m= 1.0010	$b \rightarrow a$ X-Talk m= 1.0007

000132

11/19/04

# PAL - Gas Flow Proportional Sample Analysis LB4100-B

Unit Type: LB4100-B  
 Counting Unit ID: Aquia  
 High Voltage Mode: Simultaneous  
 Application Revision: Standard  
 Application Version: Rev.12/29/03 JE

Date file name: SR0210  
 Batch ID: SR09 VERIF  
 Count Preset (m): 60  
 Batch Ended: 2/10/04 13:00  
 Alpha efficiency logfile: Am241-1103  
 Alpha attenuation calibration: ABA1103.XLS  
 Beta efficiency logfile: S-88-1103  
 Beta attenuation calibration: ABA1103.XLS

Date of Bkg. Cal: 2/7/04  
 Alpha efficiency logfile: Am241-1103  
 Alpha attenuation calibration: ABA1103.XLS  
 Beta efficiency logfile: S-88-1103  
 Beta attenuation calibration: ABA1103.XLS

Det. ID	Sample ID	Count End	Date & Time	Alpha Activity			
				Count	Resid. Dur.	Gross CPM	Bkg. CPM
C1	0414016-S1	2/10/04 13:00	60.00	0.0	0.533	0.109	0.153
C2	0414016-S2	2/10/04 13:00	60.00	0.0	0.483	0.124	0.149
C3	0414016-S3	2/10/04 13:00	60.00	0.0	0.887	0.138	0.183
C4	0414016-B1	2/10/04 13:00	60.00	0.0	0.217	0.119	0.001

Alpha Attenuation		Beta Attenuation	
$y = b \cdot m^x / (e^{(mass \cdot x)})$		$y = b \cdot m^x / (e^{(mass \cdot x)})$	
Alpha $b=$	1.24550	Beta $b=$	1.0000
$m=$	0.99400	$m=$	0.9999
$a=$	1.00000	$a=$	1.0000
$x=$		$x=$	
$\chi^2=$	0.00000	$\chi^2=$	0.0000
$\alpha=$		$\alpha=$	
Alpha to Beta X-talk		Beta to Alpha X-talk	
$y = b \cdot m^x \cdot mass$		$y = b \cdot m^x \cdot mass + b$	
$a \rightarrow b$ $m=$	0.2740	$b \rightarrow a$ $stalk$ $m=$	-2.00E-06
$a \rightarrow b$ $stalk$		$b \rightarrow a$ $stalk$	
$b \rightarrow a$ $b=$	1.0010	$b \rightarrow a$ $b=$	0.0007

000133

PC 2/11/04

# Paragon Analytics, Inc.

pg 273536 a  
(cont. from pg μA b)

Low Background Gas Flow Proportional Counter Log  
Instrument: LB4100B

## Instrument Background and Response Checklist

Instrument Background and Response Checklist																											
	Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Cmnt	On-line	Det	DR 1	DR 2	DR Stat	Cmnt	Bkg 1	Bkg 2	Cmnt	On-line									
P-10 Supply	P-10 Flow																										
1. <i>Q5D</i>	A	✓																									
2. <i>DVU</i>	B		✓																								
	C			✓																							
	D				✓																						
<i>Bkg.</i>	<i>Cnt. File ID</i>																										
Dr A	0402026000																										
Dr B	0402025700																										
Dr C																											
Dr D																											

P = passes; R = Recount; H = High; L = Low; W = weekly; α = Alpha; B = Beta; DR = Daily Response Check; Stat = Status; Det = Detector; Bkg = Background;  
 J = Not Processed.  
 OL = Offline; NP = Not Processed.

## Runlog

Det	Sample ID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outpt. Init.	Outpt. Date	Count Below
1-16	DR Checks	—	—	EFB0210	30	0615	LCB	LCB	2/10/04	N/A
1-16	Bkg Checks	—	—	BRK130210	60	0620	LCB	LCB	2/10/04	
10-12	Bkg Recount	—	—	BYB0210A	60	0732	LCB	LCB	2/10/04	
1-4	Offshore-SLS, SSS	140007A.XLS	Razzocallib	ERPB210A	30	0845	G	G	2/10/04	
5-8				ERPB210B	1	0853	G	G		
9-12				ERPB210C	1	0858	G	G		
13-16				ERPB210D	1	0904	L	L		
1	0402021-1	AB040205-4	d13	ABP0210	120	0922	OJ	OJ	2/10/04	
2	04020201MS	1	✓	✓	✓	✓	✓	✓		
4	AB0402054EC	1	✓	✓	✓	✓	✓	✓		
7	0401088-1	AB040205-3	o13	ABP0210A	120	0923	OJ	OJ		
8		—2	✓	✓	✓	✓	✓	✓		
9		—3	✓	✓	✓	✓	✓	✓		
10		—4	✓	✓	✓	✓	✓	✓		
11		—5	✓	✓	✓	✓	✓	✓		
12	0401089-1									

Paragon Analyzers, Inc.

Low Background Gas Flow Proportional Counter Log

Instrument: LB4100B

Date: 2/10/04

Det	SampleID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Comments
13	040108P-2	48040205-3	α/B	AB00210A	120	0423	g	g	2/10/04	r1A
14	-3		L				L	L		
15	-4		L				L	L		
16	-5		L				L	L		
<i>3/10/04</i>										
9	011016-51	25955a	Si 89	SR00210	6030	7/153	g	g	2/10/04	
10	-52		L				L	L		
11	-53		L				L	L		
12	0414016-B1									
1	0401089-6	18040205-3	α/B	AB00210B	120	1157	g	g	2/10/04	
2	-7		L				L	L		
4	18040205-34B									
7	-3LCS		L				L	L		
8	-3LSD		L				L	L		
13	0419012-S1	140025Rw.XLS	Si 90	SR00210A	60	1202	g	g	2/11/04	
14	-52		L				L	L		
15	-53		L				L	L		
16	-54		L				L	L		
1	0401020-1	18040205-1	α/B	AB00210C	1000	1415	g	g	2/11/04	
2	-2		L				L	L		
4	0402019-1		L				L	L		
7	-D		L				L	L		
8	-2		L				L	L		
9	0402020-1		L				L	L		
10	AB00205-4MB		L				L	L		
11	0401029-14	AB004003-1	α/B	AB00210D	1000	1417	g	g	2/11/04	
13	-15		L				L	L		
14	-16		L				L	L		
15	AB040203-1MB		L				L	L		

Form 780t6.frm (4/6/2001)  
Comments:

Reviewed LW3

Date 2/11/04

000135

pg \_\_\_\_\_ a  
 (cont. from pg N/A \_\_\_\_\_ b)

Radiation Survey Log  
 Low Background Gas Flow Proportional Counter Log  
 Instrument: LB4100B

*Instrument Background and Response Checklist*

P-10 Supply	P-10 Flow	Det	DR 1	DR 2	DR Stat	Count	Bkg 1	Bkg 2	Bkg Stat	Count	On-line	Det	DR 1	DR 2	DR Stat	Count	Bkg 1	Bkg 2	Bkg Stat	Count	On-line
	1	L <sub>α</sub> B	P																		
LB50	A $\alpha, \beta$	1	L <sub>α</sub> B	P	L <sub>α</sub> B	P															
2/0230	B	2																			
C		3																			
D		4																			
Big.	Cat. File ID	5																			
Dr A	0400 206ww	6																			
Dr B	0400 206ww	7																			
Dr C		8																			
Dr D																					

P = passes; R = Recount; H = high; L = low; W = weekly;  $\alpha$  = Alpha; B = Beta; DR = Daily Response Check; Stat = Status; Det = Detector; Bkg = Background; OL = Offline; NP = Not Processed.

*Runlog*

Det	SmpID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Count Below
1-16	DR checks	-	-	EFD021A	30	075C	L <sub>α</sub> B	L <sub>α</sub> B	2/11/04	/
4-5-6	DR Recount	-	-	EFD021A	30	0806	L <sub>α</sub> B	L <sub>α</sub> B	2/11/04	
1-16	Dray Cheevers	-	-	BK021A	60	0816	L <sub>α</sub> B	L <sub>α</sub> B	2/11/04	
1-4	201400-S123, S133	140041A-XL	Re226cal.	EFRB211A	30	0922	G	G	2/11/04	
5-8				EFRB211B	0934					
9-12				EFRB211C	0941					
1-3-16				EFRB211D	0958					
1	041232-1	AB 040209-2	$\alpha, \beta$	AB0211	60	1034	G	G	2/11/04	
2										
4		-2								
7		-3								
8		-4								
9		-5								
10		-6								
11		-7								
12		-8								

Form 780-Gtrm (4/6/2001)

© 2001 Comtrol Inc.

Reviewed by  
 G

Dated 1/16/04

Date: 2/11/04

## Low Background Gas Flow Proportional Counter Log

Instrument: LB4100B

Det	SampleID	Batch	Test	File ID	Cnt Dur. (minutes)	Start Time	Anal. Init.	Outp. Init.	Outp. Date	Count Below
12	0404019-S1	2595589	8589	SRB0211	30	1030	5	5	2/11/04	60
14	L -52			L			L	L		
15	L -53			L			L	L		
16	L -B1			L			L	L		
1	04040232-9	A00402054-0	613	AB0211A	60					
2	-915									
4	-16									
7	-11									
8	-12									
9	-12D									
10	AB04020530M8									
11	L -245	A0040205-2	613	AB0211B	10	1147	3	3	2/11/04	
12	0404017-1	A0040205-2	613	AB0211B	10	1147	3	3	2/11/04	
14	L -2			L			L	L		
15	AB04020530B									
14	0404017-1D	A0040205-2	613	AB0211C	10	1215	3	3	2/11/04	
15	AB04020530CS									
16	L -2425									
1	040401311-2	R4040206-1	6228	RB0211	250	1327	3	3		
2	040402019-1									
4	L -2									
7	040402023-11									
5										
9										
10										
11										
12										
13	R4040206-14B									
14	L -165									

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES

卷之三

Matrix CAT Prep Analyst

Prep Date Oct 11, 2014

D. mentum2 ( V /  ) Batch 14D11(0)

Prestament: (1) 1

Paragon WO No.

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES

11

Prep Analyst

Printed 2 (V) Batch 14D16038

卷之三

Paragon WO No.

卷之三

Date 22/10/04 Spike Witness Adil

Date 2/16/04 QASS? ( Y  N  ) No. \_\_\_\_\_

Isotope Enrichment No						
	Act/mL	P	Vol	Conc. (ppm)	Corrected	Enrichment of 2004
Spike 1	$^{89}\text{Sr}$	135.763.36	w 100	1.0ml	w 1100	1200
Spike 2	$\text{Sr Cappie}$	247.910	NA	0.5ml	NA	ST CO <sub>2</sub>
Spike 3	top	414.04				
Spike 4						

For more details see the Promisheet No 6 (if / when generated)

Reviewed by / Date Nik 2/1/2021

259555

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES / ACTINIDES

B

Initials	Date	Method (SOP / Rev)	Method (SOP / Rev)	Comments	Matrix
AT	2/11/04	IA	IA	Sr Standard verification - Spike + carrier added directly to PLAQUE - HCl HNO <sub>3</sub> added (uSm) to convert HCl - PLAQUES DRIED ON HOTPLATE	matrix ATTEZ

Reviewed by / Date

AT 2/11/04

Page 2 of 2

Page 2 of 2 Form 79810.fim (5/12/2002)

000139

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES

Spike No.	Serial No.	Act / mL	Vol	Total Act (dpm)	PIPE		Received by / Date
					Deoxy- <sup>14</sup> C	Relinquished by / Date Corrected	
Spike 1	135.2613.35	852	~114.221	~114.223	BSC 10	1	
Spike 2	241910	Starch	0.5	NA	STO 02		
Spike 3							
Spike 4							2

Electronic Benchsheet No. 511 / when generated)

Reviewed by / Date : J. S. C. 2/14/09

Page 1 of 2 Form 798r0.frm (5/12/2002)

259558

Paragon Analytics, Inc.

## WORKSHEET FOR IN-HOUSE OR RUSH SAMPLES / ACTINIDES

Initials <u>CJ</u>	Date <u>2/11/04</u>	Method (SOP / Rev) <u>LIA</u>	Matrix <u>URAT-EK</u>
COMMENTS			
<p><u>BY SR VERIFICATION</u></p> <ul style="list-style-type: none"> <li>- w 5ml 16KHO<sub>3</sub> ADDED TO PLANCHET</li> <li>- SPIKE &amp; CUP LEFT ADDED TO PLANCHET</li> <li>- PLANCHETS DRIED ON HOT PLATE</li> </ul>			

Reviewed by / Date JKL 2/11/04Reviewed by / Date JKL 2/11/04

Page 2 of 2

Page 2 of 2 Form 79810.frm (5/12/2002)

000141